

Journal of Applied Microscopy and Laboratory Methods

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No. 9

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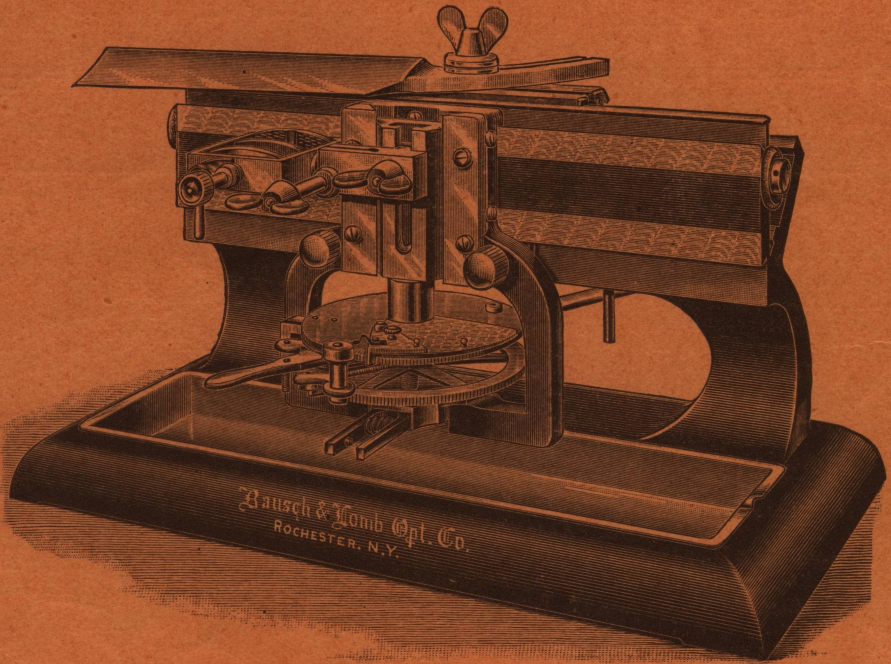
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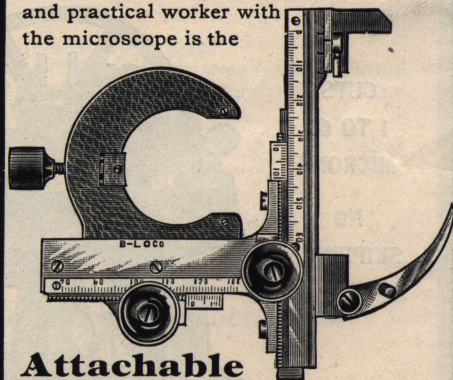
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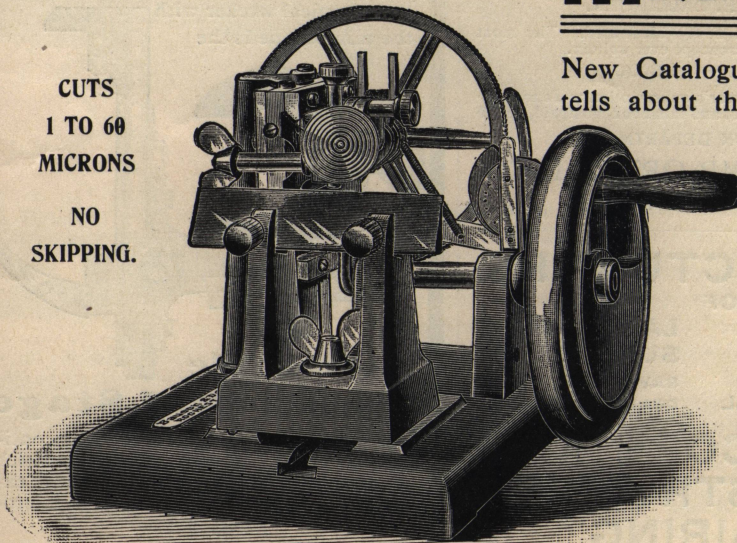
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ICHIMURA, T.—Pflanzenverbreitung auf dem Tateyama in der prouing Etchu.

MAKINO, T.—Pflantæ Japonenses Novæ vel minus Cognitæ.

ARTICLES IN JAPANESE.

ASO, K.—On Oxydase in Kaki-Fruit.

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NUMBER 9

Laboratory Courses by Correspondence.

Not every one who desires an education finds it possible to spend three or four years at a university. Many teachers with only a high school education hold good positions which they would not feel justified in resigning for an extended course of study. Correspondence courses carefully planned by competent instructors enable such teachers, while still holding their positions, to devote some time to a systematic study of branches connected with their work, and thus to increase their own knowledge and at the same time be better prepared to instruct their pupils. Those who are working for university degrees, but are compelled to spend the shortest possible time in residence at the university, find in the correspondence system a solution of the problem. Others who are neither teachers nor university students are deeply interested in particular subjects; such people, even when relying entirely upon their own resources, will advance along the chosen line, but progress is more rapid and satisfactory when efforts are systematized and directed by those who have often traversed the ground before.

It has for some time been recognized that many university courses can be pursued successfully by correspondence. The favorable results secured in language, literature and history suggested that an attempt be made to conduct laboratory courses also.

Several years ago the writer was asked to conduct a course in botany by correspondence. With many misgivings as to the success of any laboratory study by this method, a course in the Morphology of Algæ and Fungi was planned and the work was begun with a single pupil. The result soon showed that a persistent student could do the work thoroughly in spite of the difficulties.

Several courses were then announced, each course being the full equivalent of the same course as conducted at the university. The following is the general plan for the Algæ and Fungi and the other two morphological courses are similar: Material, selected with extreme care, is sent to the student and all preparations for the microscope which require a knowledge of technique are also included. The directions for study are in the form of twelve lessons, each lesson covering three laboratory exercises as conducted at the university. In the laboratory work more than fifty types are studied, and these are arranged so as to

give a view of the structure, development and relationship of all the great groups of Algæ and Fungi. The lack of lectures is compensated for by assigned readings and the study of a larger number of types. As soon as a lesson is completed, it is sent to the instructor, who returns it with corrections and suggestions.

Three courses in botany, (1) General Morphology of the Algæ and Fungi, (2) General Morphology of the Bryophytes and Pteridophytes, and (3) General Morphology of the Gymnosperms and Angiosperms, have been thoroughly tested by the writer, nearly a hundred students having taken the work. The results are surprising. Many students after taking one or more of these courses by correspondence have come to the university for further work, and have not only been able to hold their own in classes with students who had done the previous work in residence, but, on the whole, have shown a more thorough preparation.

However, it must not be inferred that correspondence work is preferable to residence work, for such is not the case. The explanation is to be sought in the fact that those who have sufficient interest and determination to carry on a course by correspondence are willing to devote more time and effort than can be required of the average university student. It is particularly noticeable that correspondence students, when they come for resident work, are more independent and ask fewer thoughtless questions than those who have always had an instructor at the elbow. Several who have laid the foundation for morphological work by correspondence have subsequently come to the university for research work, and have published excellent papers, and two have even taken the doctor's degree, with botany as the major subject.

After the success of these courses became evident, a course in histological technique, preëminently a laboratory course, was offered and has proved a success. Work in the newer, but very popular field of Ecology, is also being conducted satisfactorily by correspondence.

In looking over the list of those who have studied botany by correspondence, it is interesting to note that, aside from the teachers and students who form the great majority, there are also lawyers, business men, clerks and artisans, who have found time to improve themselves in their chosen subject.

The success which has attended the correspondence work in botany suggests that in other sciences also those laboratory courses which do not require very expensive apparatus may be conducted by this method.

University of Chicago.

CHARLES J. CHAMBERLAIN.

DR. W. BURCK, of the Royal Academy of Sciences of Amsterdam, has recently published some observations bearing upon the subject of the prevention of hybridisation in plants. His experiments showed that certain chemical substances act very differently on the pollen of different plants. Levulose in small quantities greatly accelerates the growth of pollen tubes in some plants, while in others the pollen grains are caused to burst. Saccharose and dextrose produce different effects than levulose. According to the author's interpretation these results would indicate the possibility that the stigmatic secretion of a given species contains substances which promote the emission of pollen tubes in that species, but prevent the growth of pollen from other species.—*Nature* 64: 1656.

LABORATORY PHOTOGRAPHY.

Devoted to methods and apparatus for converting an object into an illustration.

PHOTOGRAPHING DIATOMS.

In photographing diatoms at the University of Iowa the apparatus used is of the simplest character. It consists primarily of a "Practical" photomicrographic camera, a microscope furnished with a mechanical stage, apochromatic lenses, and with compensating and projection eyepieces. The remainder of the apparatus is mostly home made and consists of a table, condensing lenses suitably disposed, an acetylene generator, and simple lamp or burner.

The camera is hinged so that it may be used in either a vertical or horizontal position. I find this very convenient, as the bellows may be quickly raised to allow the operator to make a direct examination of the object. The working lens is a dry apochromatic, 3mm. of .95 N. A. A compensating eyepiece No. 8 and a projection eyepiece No. 4 are the oculars used. The table, which serves the purpose at once of camera table and optical bench, is about three feet six inches long. The width is about sixteen inches and the height so adjusted that when the operator sits in a chair the ocular is in a convenient position for observation.

When making an exposure the bellows is turned down and rests on the leaf of the table, which for this purpose is raised to a horizontal position.

The condenser is composed of two plano-convex lenses two and one-half inches in diameter, an achromatic pair two and one-fourth inches in diameter, and a one-inch negative to effect the parallelism of the rays. The spherical and chromatic aberration of the first system of condensers is in a large measure corrected by this simple device; and, although it is conceded that every additional lens is in a sense an added obstacle, nevertheless the advantage to be derived from the introduction of the negative in the series at this point will quickly become apparent to anyone who chooses to try the experiment.

No heat filter is necessary with acetylene gas as the illuminant. As is well known, this light is remarkably cool. The substage condenser is a plain, uncorrected Abbe.

A small acetylene generator and a *round flame* burner complete the outfit. I have adopted the round flame burner after a series of experiments involving every other form of burner offered by the trade. I certainly consider it the most desirable and efficient.

In the present discussion I shall assume that the material to be photographed is properly mounted in well cleaned styrax on cover-glasses of known thickness. For mounting the larger species a mechanical finger will be found convenient, as such species should be mounted singly. In photographing from spreads I pro-

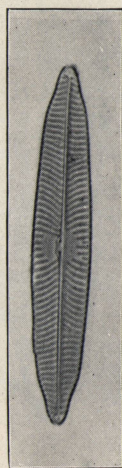


Fig. 1.

ceed as follows: By the aid of the mechanical stage I carefully review the entire slide, noting the location of every suitable specimen of the species desired, of all species not yet photographed, and their degree of perfection. Such specimens should lie in optical contact with the lower side of the cover-glass, be clearly marked and free from foreign matter. These observations are

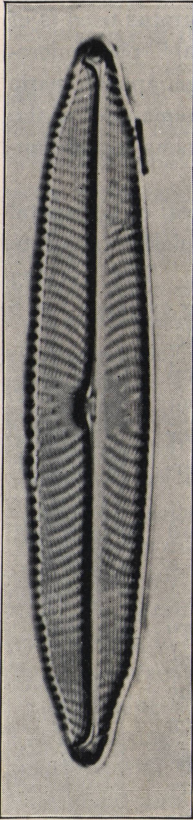


Fig. 2.

recorded with the readings of the mechanical stage, and by use of the record at any subsequent time the desirable specimens may be turned to readily and photographed without loss of time. This search work may be done by daylight or, what I consider an exceedingly good substitute, by means of the acetylene lamp with a rather dense ray filter interposed. The filter, which has given me excellent results, is simply a flat eight-ounce bottle filled with a fluid composed of 175 grams of copper sulphate, 17 grams potassium bichromate, 2 c. c. sulphuric acid and 500 c. c. of water. The color is restful and agreeable to the eyes, and the density is not sufficient to interfere in any serious way with accurate vision or inspection.

Focusing and adjusting for cover-glass thickness can be learned by experience only. As is well known, however, both arts are of the most vital importance. In this paper I shall not endeavor to give any advice on these two points except merely to mention a little matter that I have never seen elsewhere stated and which has been of great service to me. In my experience the microscope is always horizontal; this is the convenient position.

One day when working at the instrument I discovered that when I placed my fingers on the milled head of the fine adjustment screw, there ensued an alteration of the focus although the head had not been turned. Further investigation brought out the fact that the alteration was due to a springing of the arm induced by a downward pressure on the milled head, and that when the finger was removed the

object came again into perfect focus. I also found that a slight pressure upward caused the object to pass out of focus in the opposite direction.

This proved to be an exceedingly delicate test of the correctness of the focus. If perfectly focused the error produced by this slight pressure is equal in both directions; but if not perfectly focused the error will be more evident in one direction than in the other. This apparently commonplace and trifling matter is well worth the attention of anyone who attempts the photography of these very delicate and difficult forms.

The time of exposure will, of course, vary according to conditions. I use two different amplifications, 660 diameters and 1320 diameters. All my photographs are made at 660 diameters unless the objects are very small or are adorned with very fine striæ. When the forms are large and marked with fine striæ two photographs are taken; one to show simply the outline, and the other at the

higher magnification and with oblique illumination to show details, as in Figs. 1, 2 and 3.

The exposure is made as short as possible without sacrificing detail; then, if the plate be strongly developed the requisite contrast will be secured. I find, too, that it is best to make two exposures of each specimen.

On removing the plate from the holder a number is placed on one corner with a soft lead pencil, say Dixon's "Ultimatum" or one similar to it. This number is also placed in a book kept for the purpose with the name of the species, date, magnification, light, number of slide, and location. With these data it is an easy matter to re-photograph any particular specimen if at any time the negative be lost or broken, or if for any reason it prove unsatisfactory.

I have experimented with every developer to be had here, and have tested many formulas, but none of them is equal to the one known as Bromo-hydroquinon. It gives the requisite amount of contrast, a thing to be kept constantly in mind in photographing objects so very hyaline as are diatoms.

For a fixing bath plain hypo seems to give better results than the acid alum bath.

Any good plate will answer the purpose providing it is *heavily coated*; my preference, however, is "Cramer's Instantaneous Isochromatic." Let me say again, a thin plate will not answer. In order to economize, I get the 4 x 5 plates and then cut them once or twice as the size of the diatom demands; i. e., the plates are then $2\frac{1}{2} \times 2$, or $2\frac{1}{2} \times 4$. When dry they are put in appropriate envelopes, filed away in alphabetical order, and a full record of each one is kept in a card index.

Most diatoms lend themselves readily to photography, the side of the valve which is most important usually being nearly plane. Some, however, are more or less convex or concave. Figure 5 represents a species that has a ridge just inside the margin and a depressed center. This of course necessitates a compromise, with some loss of detail. Only a very few species of the fresh-water forms, however, are impossible of photography as here described.

As is well known, *Navicula* is the typical genus of the *Bacillariaceæ*, with hundreds of species; these come out beautifully, as is attested by Fig. 4.

Previous to printing, the negative is placed in a retouching frame and the background is all cut out by the application on the back of a heavy coat of "Copelin's Opaque." This cuts out everything but the image desired. For printing, all sorts of paper have been tried. Among those that I have used, of the developing sort, Velox, and of the printing sort, Solio, seem to give the best results. I have discarded Solio, however, on account of its slowness. In print-

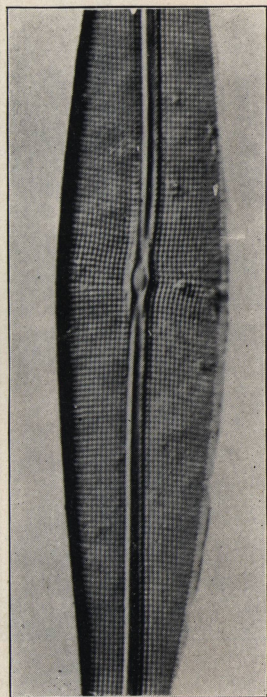


Fig. 3.

ing on Velox I proceed as follows: Six frames are prepared and arranged on the six sides of a hexagonal wire frame on which are stretched two thicknesses of white tissue paper.

This screen is about six inches in diameter, six inches deep, and open at the top. The printing frames are placed at irregular distances from the screen, according to the density of the plate in each case.

A bit of magnesium ribbon about one and one-half inches long is then ignited in an alcohol flame and instantly placed within the screen near the center. This prints all six pictures at once and they are ready to be developed. The screen prevents the edge of the opaque from printing up as a sharp line. The use of the magnesium light greatly increases the rapidity with which the prints may be produced and also contributes not a little to the sharpness of the image.

Of course, with the simple appliances here described, the highest degree of critical photography may hardly be attempted. Nevertheless, it may be readily seen, from the samples herewith submitted, that illustrations may easily be secured, sufficiently accurate for practical purposes. No doubt a better apparatus is a thing to

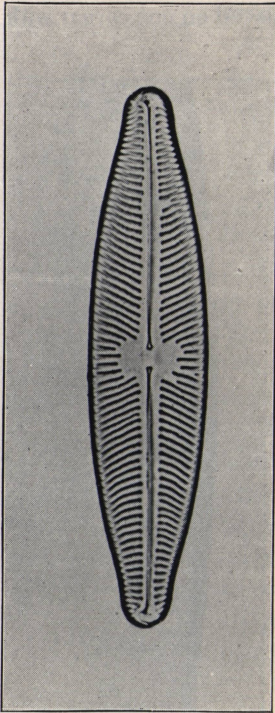


Fig. 4.

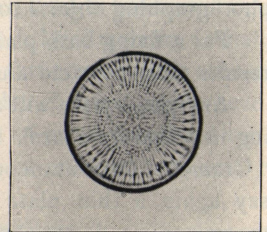


Fig. 5.

be desired. But, if the matter of expense must be taken into account at all, the apparatus which we have here described and successfully used will commend itself to many who might be prevented by the consideration of cost from attempting experiment in this most fascinating field of work. The results of our labors in this direction will form the subject of a descriptive paper presently to appear in the Bulletin of the Laboratories of Natural History of the State University of Iowa.

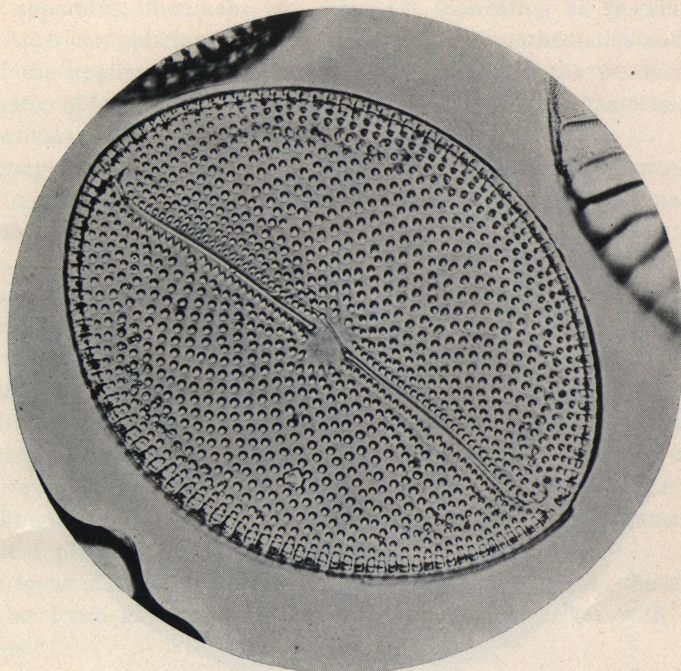
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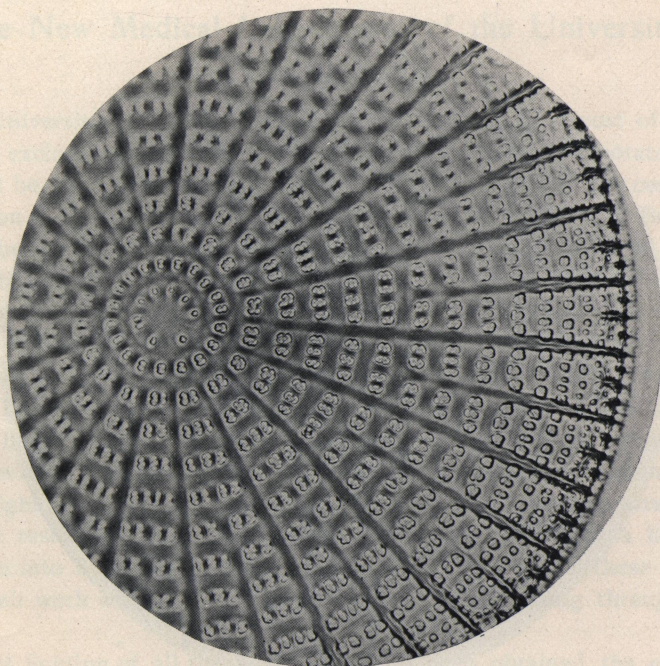
THE 5 mm. APOCHROMAT, AFTER PROF. CHARLES S. HASTINGS, IN THE PHOTOGRAPHY OF DIATOMS.

We are in receipt of a very interesting series of photo-micrographs of diatoms from Honorable A. A. Adee, Washington, D. C., made while testing a 5 mm. apochromatic objective after the formula recently computed by Prof. Charles S. Hastings, Sheffield Scientific School, Yale University.

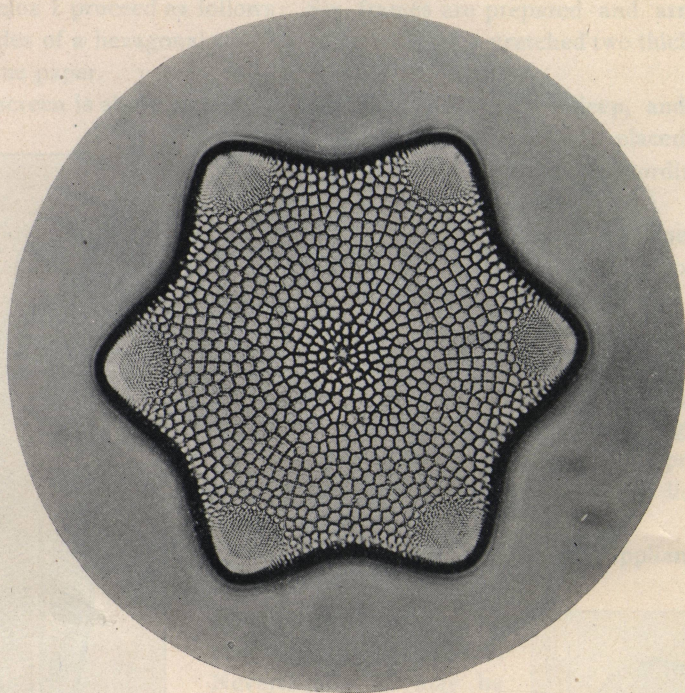
The following brief notations, in connection with data which show subject,



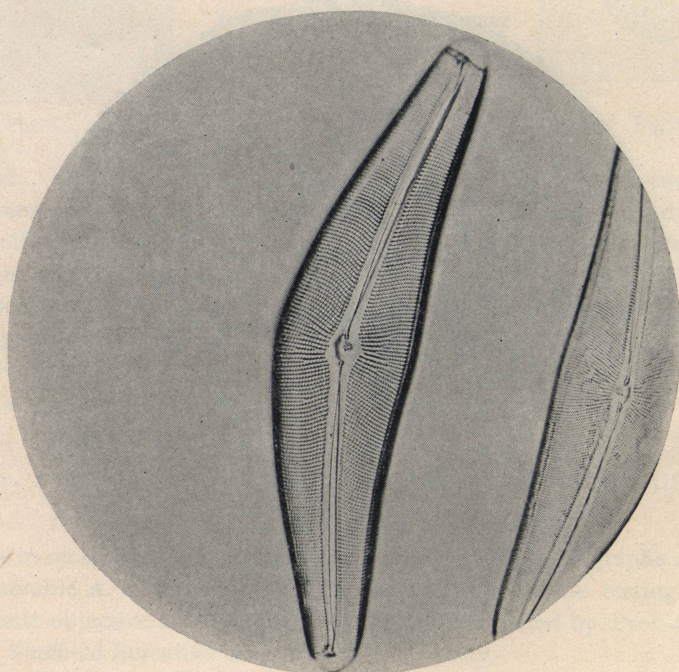
Orthoncis splendida, Grunow.



Arachnoidiscus indicus, Ehr.



Triceratium tripolare, Temp. Br.



Cymbola mexicana, Ehr.

accessory apparatus, illuminant, etc., used, are interesting as showing advance made by American opticians in constructive optical mathematics and the possibilities of the application of theoretical conclusions in the production of an apochromatic objective system, without the use of other materials than the glasses ordinarily employed :

" Although I cannot claim any expert knowledge of optical science, my experience during the past six years in difficult photo-micrography may make my test of this glass in the camera of some worth to you. I find it superior in working quality to any lens of apochromatic focus I have yet tried except the Zeiss apochromatic of 4 mm., and as to that it holds its own for photographing. The correction for actinic rays is surprisingly good, so that exquisite definition is obtainable, even with a projection ocular No. 4, and it does not bring it down under a compensation ocular No. 8. Notwithstanding the extremely wide aperture, the field is perfectly flat, so that perfect photographic definition is obtained to the edges of a large circle on the focusing screen. It bears more light than any others I have tried, and I can open the condenser and diaphragm at least 40 per cent. more than with the other glasses, and still get excellent photographic contrast.

" The focus of this lens appears to be a trifle less than 5 mm., about 4.65 mm., as nearly as I can estimate it by comparison of the negatives with it, and the Zeiss 4 mm."

L. B. E.

The New Medical Laboratories of the University of Pennsylvania.

The University of Pennsylvania is about to erect, at a cost of more than \$500,000, exclusive of grounds and equipment, a Medical Laboratory building which will be unexcelled in every respect. The trustees are also contemplating the erection in the near future of a new Medical Hall, Anatomical Building, and auxiliary buildings, which will adjoin the new laboratory about to be erected, and which will form one of the most extensive systems of buildings devoted exclusively to the teaching of medicine in Europe or America.

The new Medical Laboratory building, which will be erected at once, will be quadrangular in shape, and will be located on the south side of Hamilton walk, between Thirty-sixth and Thirty-seventh streets. The building will be two stories in height above a high basement, and measure 340 feet front by nearly 200 feet in depth. The long front faces north, securing a maximum amount of the best light for laboratory purposes. All along the front are arranged small rooms for research, rooms for professors and their assistants, a library, etc.; these open into a private corridor, so that men employed in these rooms may pursue their work without interruption from students passing through the main halls.

Perfect lighting of all the laboratories has been obtained, the courts being large enough, with the low front building, to furnish good north light to the

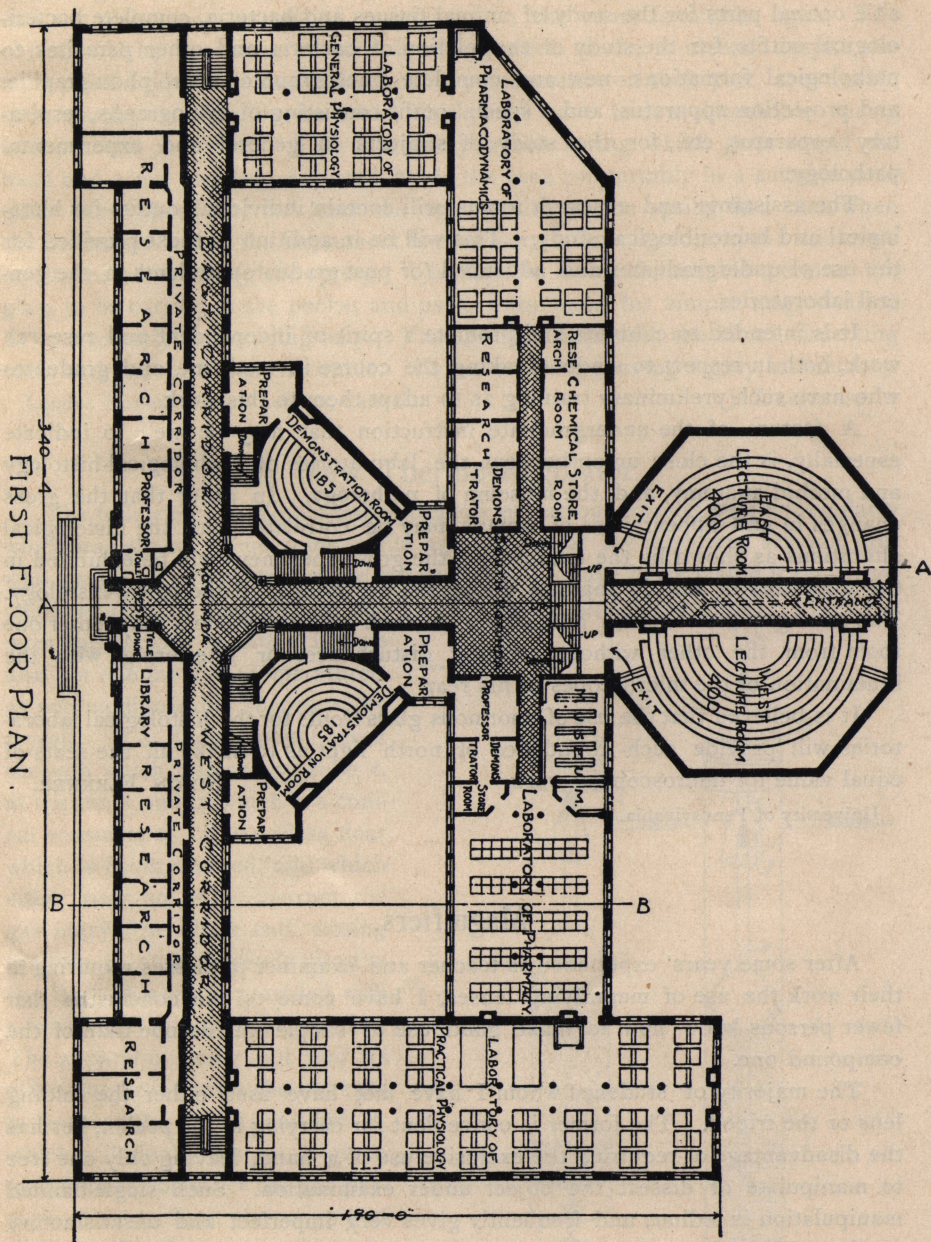
laboratory of pharmacodynamics on the first floor, and to the large laboratories on the second floor devoted to pathology, where microscopical work is done, the north front of these rooms facing on the courtyard being made almost wholly of glass, and extending higher than the front, so that steady north light will be thrown to the back of the room.

The first floor of the new laboratories will be devoted to physiology and pharmacodynamics.

The second floor will be devoted exclusively to pathology. An examination of the commodious plans will disclose the purpose of the pathological laboratory. After providing for lectures upon general topics in pathology, the chief provision is for laboratory instruction. The entire north front of the building is devoted to laboratories for advanced students in pathology and pathological bacteriology, and to the special research and assistants' rooms. Each of the advanced laboratories measures 31 x 44 feet. The east wing accommodates the laboratory of experimental and chemical pathology, while the west wing is occupied by the museum of pathological specimens. This latter, which measures 44 x 65 feet, adjoins the demonstration hall of morbid anatomy, which hall communicates with the general pathological-histological laboratory. The last laboratory, the front of which is to consist almost entirely of glass, is located in a section of the building looking north into a spacious court. This room, 37 x 100 feet, will seat one hundred students, and will be devoted entirely to microscopical work, for which, on account of the excellent lighting, it will be admirably adapted. In order to combine in one harmonious whole the study of the microscopical features of diseased organs and the gross alterations in them, the pathological-histological laboratory, the laboratory of morbid or gross pathological anatomy, and the museum of pathology are made closely communicating and freely accessible one from the other. Another section of the building, of equal size with the first, and also looking north into the court, is subdivided into three smaller laboratories for the instruction in comparative (pathology of animal diseases), neurological (pathology of nervous diseases), and surgical pathology. The same method of lighting, with enormous glass windows, is to be carried out in this group of laboratories. Finally, the west wing of the building will also provide for photographic and micro-photographic outfits.

Besides the numerous laboratories, research rooms, etc., there are four lecture rooms in the building. The two marked "Demonstration Rooms" on the plan each seats 184 students. These lecture rooms communicate with two preparation rooms each. At the rear of the building there are two large lecture rooms, each seating 400 students. To avoid confusion between lectures, the corridors and stairways are so arranged that one class enters the large lecture room from one side as the other class leaves it from the opposite side. Students enter these rooms from a landing at the main stair, midway between the first and second floors. The floor of the lecture room is on a level with the basement, and the lecturer will enter directly from the basement level, and all specimens needed to illustrate the lectures will be brought through the entrance, thus saving the crossing of the halls through which classes move.

The equipment of the laboratory will be adequate and in keeping with the



FIRST FLOOR PLAN.

advanced ideas of the times regarding laboratory instruction. That of the physiological department will be described at another time. The outfits for the laboratories of pathology will include modern microscopes, furnished with suitable optical parts for the study of animal tissues and bacteria, complete bacteriological outfits, for the study of the relation of bacteria and other parasites to pathological formations, new and complete photographic, micro-photographic, and projection apparatus, and a special outfit consisting of kymographs, respiratory apparatus, etc., for the study of subjects in general and experimental pathology.

The assistants' and research rooms will contain individual outfits for histological and bacteriological study. This will be in addition to those provided for the use of undergraduates and advanced (or post-graduate) students in the general laboratories.

It is intended to cultivate and promote a spirit of independent and research work, both in respect to students taking the course in medicine and graduates who have such preliminary training as to adapt them to this work.

A feature of the undergraduate instruction that may be well to indicate especially, is the close union between the laboratories of pathological-histology and morbid anatomy, and the museum of pathology. In order that the gross changes in and appearances of organs may be correlated with the histological alterations as shown by the microscope, the gross specimens will be exhibited in the laboratory of morbid anatomy during the exercises on pathological-histology. The arrangement of rooms and seating is such that the student may enter one room from the other without creating disturbance, or interfering with the illumination of the microscopes in his rear.

It is believed that the use of enormous glass fronts for the histological laboratories will provide such abundance of north light as to make all the seats of equal value for microscopical work.

SIMON FLEXNER.

University of Pennsylvania.

Magnifiers.

After some years' experience as teacher and examiner of classes requiring in their work the use of magnifying lenses, I have come to the conclusion that fewer persons know how to make good use of simple microscope than of the compound one.

The majority of students whom I have met have used either the folding lens or the tripod. The former is convenient for carrying in the pocket, but has the disadvantage of requiring the exclusive use of a hand, leaving only one free to manipulate or dissect the object under examination. Such single-handed manipulation is tedious and frequently gives very imperfect and unsatisfactory results. With wire and cork, one can improvise a holder for the folding magnifier, but so mounted it is less satisfactory than the tripod.

Within two years I have tried, with three classes of nearly one hundred students in each, the magnifier known as the watchmaker's glass with two

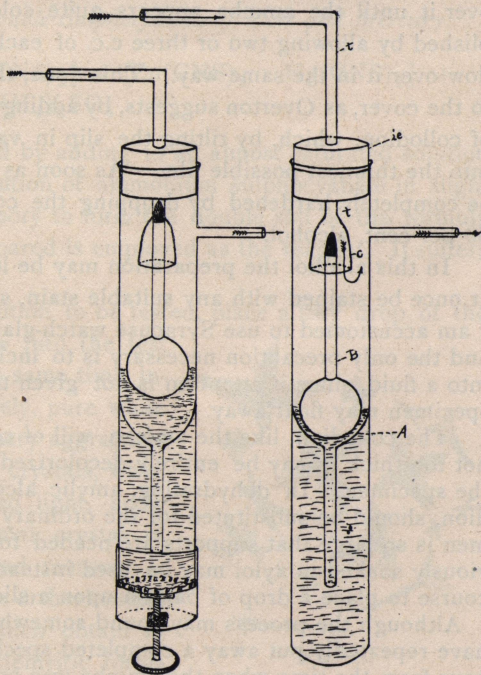
lenses. The lens on the tip may be removed, thereby rendering the remaining lens lighter to hold in the eye, while at the same time giving sufficient amplification for most work. The great advantage of this magnifier is that both hands are free, and the object can be placed or held up in the most favorable light. The objection to its use is that a considerable portion of the students, despite the most careful directions and praiseworthy perseverance on their part, are unable to retain the magnifier on the eye. This year I have had a detachable spring added to the mounting. This is a heavy watch spring which goes round the head and when properly adjusted holds the lens comfortably in a suitable position. Even those who can hold the lens on without the spring find that when the protracted use of the instrument is necessary fatigue is reduced to a minimum or eliminated by using the spring. The latter's being detachable permits the glass to be carried in the pocket and used in the hand for simple magnification as conveniently as a folding lens. The spring is kept with the kit of dissecting tools and attached when desirable. Its use so far is proving highly satisfactory.

London Normal School, London, Canada.

J. DEARNESS.

A New Thermo-Regulator.

The following is a simple and extremely efficacious form of thermo-regulator which was shown to me some while ago by one of my ingenious friends, and who kindly undertook to provide me with one. I have been trying it on an air sterilizer (one of Jung's) with the most satisfactory results. I have also got one for low temperatures, as per modifications suggested by myself: i.e., india rubber cork through which passes the tube *t*, at the inner end of which is a conical entrance, *c*. *B* is a glass float which is counterpoised, and which either rises so as to obstruct the gas entry (the black end closing the tube *t*), or it descends into the cup *A*. This cup is provided with a tube which dips into the mercury. The apparatus being put into its place, the heat causes the mercury to rise into the cup *A*, and lifts *B*, which will finally, i.e., at a given temperature, obstruct the gas passage so as to limit the supply of gas, and thereby govern the temperature.



The form shown is, of course, serviceable for only one temperature, but by interposing a metallic cap and screw, as shown in the left figure, acting on a leather diaphragm, the apparatus may be regulated to any temperature.

THOS. PALMER.

A Rapid Method of Making Slides of Amoeba.

If a small film of detritus which contains abundant amœbæ be placed in a solid watch glass with plenty of water and examined with a magnification of 10 to 20 diameters, amœbæ can, after a little practice, be readily seen and can be picked out with a thin-walled dipping tube such as any one can readily make for himself. The medicine droppers which one buys have walls too thick to be available.

The drop of water containing the amœba may be placed on a coverslip and with a little care any fragments of dirt taken up with it can be removed to a distance by needles and then taken away altogether by a cloth or a bit of filter paper. With a little experience also it will be easy so to manipulate the currents as to bring the amœba to the center of the slide. As much water should be drawn off as is possible without incurring the risk of allowing the animal to dry. After he has been quiet for a few moments and has begun to put forth his pseudopodia, he adheres slightly to the glass and it is now possible by a sudden move to drain off the rest of the water and to replace it by a small drop of picric alcohol (saturated solution of picric acid in 50 per cent. alcohol). If the alcohol is placed directly upon him and is not allowed to fall from any considerable height, the attachment to the glass will not be loosened. The cover may now be inclined somewhat and a gentle current of 50 per cent. alcohol allowed to flow over it until the amœba appears quite colorless. Dehydration may be accomplished by allowing two or three c.c. of each of the higher grades of alcohol to flow over it in the same way. This done, the animal may be permanently fixed to the cover, as Overton suggests, by adding a small drop of a very dilute solution of collodion, which, by tilting the slip in various directions, may be spread out into the thinnest possible film. As soon as the collodion ceases to flow it may be completely hardened by dropping the cover, amœba-side up of course, into 80 per cent. alcohol.

In this alcohol the preparation may be left as long as convenient, or it may at once be stained with any suitable stain, such as borax carmin or hæmatoxylin. I am accustomed to use Syracuse watch-glasses for manipulation of such covers, and the only precaution necessary is to incline the cover somewhat as it is put into a fluid, since if attention is not given to this point the entire film with the specimen may float away.

The collodion, like the amœba, will of course be colored, but if the film was not too thick it may be entirely decolorized before the color is withdrawn from the specimen. In dehydrating, amylic alcohol, which does not dissolve collodion, should be substituted for the ordinary absolute ethyl alcohol. If the specimen is so large that supports are needed for the cover, two slips of paper previously soaked in xylol may be used instead of wax feet. The final step is of course to place a drop of balsam upon a slide and invert the cover upon it.

Although the process may sound somewhat tedious, it is really a rapid one. I have repeatedly put away a completed specimen in my cabinet less than half an hour from the time when the amœba was crawling about in his home. I should add that I have not made any cytological study of specimens prepared in this way. For purposes of demonstration, however, they are exceedingly satisfactory.

MICRO-CHEMICAL ANALYSIS.

XVI.

ZINC.

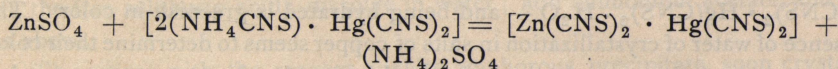
Although zinc, from its position in the periodic system, closely resembles magnesium in general, in its chemical behavior, the majority of the micro-chemical reactions of the two elements are quite different. We have already seen, however, that with uranyl acetate and sodium acetate, and with arsenic acid, magnesium, zinc and cadmium give identical reactions.

A number of reagents have been proposed for the detection of zinc, but of these only the following need to receive our attention :

- I. Double Sulphocyanate of Mercury and Ammonium.
- II. Oxalic Acid.
- III. Primary Sodium Carbonate.

Of these, the third is the most sensitive and most characteristic, but is not so simple, convenient nor so easily applied as is the first. The second reagent—oxalic acid—is unsatisfactory and of comparatively little value.

I. Ammonium Mercuric Sulphocyanate added to neutral or slightly acid solutions containing Zinc, precipitates a Double Sulphocyanate of Zinc and Mercury.



Method.—The reagent is prepared by adding to an almost saturated solution of mercuric chloride a saturated solution of ammonium sulphocyanate in slight excess of the amount required by theory to form the double salt of the formula given above. The solution thus prepared is employed as the reagent. It suffers no deterioration on keeping.

Next, to a small drop of the solution to be tested, place a tiny drop of the reagent and cause the latter to flow into the test drop by means of a glass rod, at the same time inclining the slide. Almost immediately, pure white feathery crosses and branching feathery aggregates separate (Fig. 68). These skeleton crystals, when thick, appear black by transmitted light, snow white by reflected light. The normal crystal of the double sulphocyanate of zinc and mercury is said to be a right-angled prism of the orthorhombic system, but under the conditions which obtain in ordinary practice, only skeleton and dendritic forms will be seen.



Fig. 68.

Remarks.—Employ dilute solutions only. Mitigate the action of free mineral acids by the addition of ammonium or sodium acetate.

Avoid adding too much reagent. This, however, is a matter of little importance when zinc alone is present, but it is quite necessary when dealing with mixtures.

Neither magnesium nor aluminum interfere with this test, save that when magnesium is present in large amount the separation of the zinc salt is retarded, and that aluminum under similar conditions renders the skeleton crystals of the zinc salt somewhat less feathery.

The reagent gives reactions with zinc, cadmium, copper, cobalt and indium. These reactions are among the most interesting and elegant of micro-chemistry and leave little to be desired.

When zinc alone is present the crystals, as has been stated above, are snow white and of the form shown in Fig. 68; but if copper is present in minute amount, the crystals of the zinc salt are colored chocolate brown without undergoing any change of form. These brown crystals begin to appear after the white ones have separated. More copper than sufficient to yield the brown tint produces black crystals of modified form; still a greater proportion of copper completely changes the appearance of the crystals, and jet black spheres and botryoidal masses result. Finally a point is reached where crystals of copper mercuric sulphocyanate predominate, accompanied by the black crystals just mentioned.

This change in color of the zinc salt brought about by the presence of copper is a most interesting one. The zinc compound — $\text{Zn}(\text{CNS})_2 \cdot \text{Hg}(\text{CNS})_2$ — contains no water of crystallization, while the copper salt normally separates as — $\text{Cu}(\text{CNS})_2 \cdot \text{Hg}(\text{CNS})_2 \cdot \text{H}_2\text{O}$ — and being hydrated is greenish in color. The presence of water of crystallization in salts of copper seems to determine their color. The removal of the water leads to the production of a brown or almost colorless body. The nature of this change is not yet thoroughly understood. It seems probable that in the case of the brown and black copper-zinc-mercury sulphocyanates we have to deal with a case of solid solution, although it is also conceivable that an anhydrous copper-mercury double salt may exist in the presence of the zinc compound, isomorphous with the latter, yet incapable of existing alone.

In the presence of cobalt, the zinc salt is colored blue, the intensity of the coloration depending upon the amount of cobalt present. With very small amounts the color is exceedingly faint and the crystal form unchanged, but as the proportion of cobalt increases, the skeleton crystals of the zinc salt become deeper and deeper blue, simpler, less feathery, and gradually assume the color and appearance of the normal cobalt mercuric sulphocyanate. As in the case of the copper-zinc compound, these blue crystals are doubtless cases of solid solution, but the theory of isomorphous mixture is more tenable in this case than in that where copper is present.

Small amounts of zinc in the presence of much cobalt cannot be detected by this reagent.

Cadmium gives long prismatic crystals (Fig. 71), which are more soluble than the zinc salt. Even a small amount of cadmium destroys the feathery and branched character of the skeletons of the zinc-mercury sulphocyanate, owing

to the formation of mixed crystals, and there generally result crystallites of the shape of an arrowhead. Small amounts of zinc in the presence of much cadmium will usually escape detection.

The presence of both copper and cobalt in a solution containing zinc gives rise to the formation of mixed crystals of very peculiar color and form. These peculiarities are accentuated when cadmium is also present. The experienced worker thus will have little difficulty in detecting a number of elements in one single operation.

Indium forms with the reagent a double sulphocyanate, crystallizing in forms resembling those of the corresponding cadmium double salt. The reaction is quite slow in the case of indium.

When iron is present in sufficient amount to give a blood-red color to the preparation on the addition of the reagent, the crystals of the double sulphocyanate of zinc and mercury, separating from such solutions, are colored a deep reddish brown, appear jet black by transmitted light, and have at first the usual form of the zinc double salt. The appearance of these crystals usually changes rapidly, and in a few seconds bunches and masses of curving, branching, filiform crystals are seen. The change is a very remarkable one and takes place rapidly.

Lead, unless present in large amount, seems to have little or no effect on the zinc reaction. Under some conditions it seems to interfere, however, and it is, therefore, always best to first remove the lead by means of dilute sulphuric acid. Add the acid, draw off or filter; evaporate the clear solution to dryness; fume off the free sulphuric acid; dissolve in water; add ammonium acetate, and test as above.

Silver gives with the reagent a white amorphous precipitate, soon crystallizing in the form of small, thin, slender prisms with square or oblique ends, somewhat resembling those of the cadmium-mercury salt, but very much smaller than the latter. In the presence of silver the test for zinc is sometimes masked. In such an event, first remove the silver with hydrochloric acid and test, after evaporation, in the usual manner.

Exercises for Practice.

Apply the reagent, in the manner indicated, to solutions of a pure Zn salt of different degrees of concentration.

To a Zn solution add a very little Cd and test. Repeat the experiment, using more Cd.

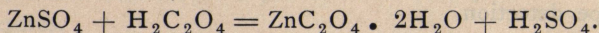
In like manner try mixtures of Zn and Cu; Zn and Co; Zn and Ni; Zn and Fe; Zn and Mg; Zn and Al; Zn and Pb; Zn and Ag.

Then try more complex mixtures, as for example: Zn, Cd and Cu; Zn, Cd and Co; Zn, Cu and Co; etc.

In each case prepare several slides under different conditions and note well the changes in the appearance of the crystals which separate.

See also remarks and suggestion of experiments given under Cadmium, Copper and Cobalt.

II. Oxalic Acid added to solution containing Zinc causes the separation of Zinc Oxalate.



Method.—The reagent is applied to the test drop, as in previous tests, with oxalic acid, i. e., employ a concentrated solution and cause it to flow into the test drop.

Small double spherulites, pseudo-octahedra, either singly or united in twos, and thin rhombs result. (Fig. 69.)



Fig. 69.

The great majority of the crystals separating have their angles rounded. It is rare that a preparation is obtained yielding clear-cut crystals.

Remarks.—The solution to be tested should be neutral or only slightly acid.

Crystals of zinc oxalate, when examined with a low power, often bear a striking resemblance to the oxalates of calcium and strontium; for this reason the alkaline earths should be first removed.

Magnesium interferes. Under certain conditions a double oxalate of zinc and magnesium separates in the form of hexagonal plates.

Ammonium salts should be removed before adding the oxalic acid.

In the presence of cadmium this test for zinc is unreliable.

Recrystallization of the zinc oxalate from a solution of ammonium hydroxide sometimes yields good results, and will aid in reaching a decision as to what element has been precipitated by the oxalic acid. In recrystallizing proceed as follows after adding the oxalic acid: Carefully separate the solution from the precipitate; add to the latter a large drop of ammonium hydroxide; warm gently; cool and examine. Zinc oxalate separates from such solutions in the form of tufts and aggregates of very fine needles. Occasionally masses of radiating, curving needles are seen. In most preparations the crystals separating resemble the tufts formed by calcium sulphate. These crystals are not obtained if cadmium or magnesium is present.

If lead, copper, cobalt or nickel should be present, it is necessary to first effect a separation before testing for zinc with oxalic acid.

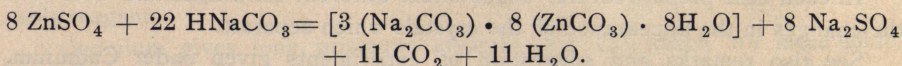
Unless present in very small amount, iron interferes.

Oxalates of Group I also yield precipitates consisting of normal and double oxalates, but these are of little value as tests for zinc.

Exercises for Practice.

See suggestions under Cadmium.

III. Zinc forms, with Primary Sodium Carbonate, a Double Carbonate of Zinc and Sodium of low solubility.



Method.—Prepare a saturated solution of the reagent. Place a large drop

of this solution next to the drop to be tested. Tip the slide a very little and cause the reagent to flow into the test drop. An amorphous precipitate of basic zinc carbonate is generally at once produced. After a short time, if the reagent is in excess, the double carbonate will appear at the edges of the test drop nearest the reagent as small, colorless, triangular and tetrahedral crystals. (Fig. 70.) These crystals adhere strongly to the glass and are very characteristic of zinc.

Remarks.—It is essential that an excess of the reagent be employed. Failure not infrequently results from a neglect of this precaution. This is particularly true if the test drop is acid. Because of the necessity of adding large amounts of primary sodium carbonate, the test drop must be of greater volume than is usual in micro-chemical testing and must be correspondingly dilute.

The formation and separation of the double salt is rather slow.

Other carbonates, as for example, those of potassium and lithium, can be substituted for primary sodium carbonate, but the reactions are not so satisfactory.

Salts of ammonium must be absent.

It is unfortunate that this, which is one of the most characteristic as well as delicate of the micro-chemical tests for zinc, should be open to many difficulties. The chief of these lies in the fact that many elements are precipitated as carbonates, and that these often bulky precipitates interfere with or mask the zinc reaction. Among the interfering elements, those most frequently met with are doubtless calcium, strontium, barium, magnesium, cadmium, lead, iron, manganese, cobalt, nickel. Of this list, calcium, strontium, barium and lead will probably have been removed by previous treatment with sulphuric acid. For method for dealing with mixtures containing the remaining elements of the list, see Separation of the Magnesium Group.

If only a very small amount of cadmium is present, it is precipitated before the zinc, and by avoiding the addition of an excess of the reagent, drawing off the clear liquid and adding to the decanted liquid a fresh portion of the reagent in sufficient quantity, the zinc can be precipitated as the double carbonate. When considerable cadmium is present this method is not feasible. In such an event recourse may be had to ammoniacal solutions, as suggested by Behrens.* The test drop is made strongly ammoniacal and to it primary sodium carbonate is added. Cadmium is immediately precipitated, while the zinc remains in solution. The clear solution is separated at once from the precipitate and allowed to stand for a short time. Zinc separates from the decanted solution as the double carbonate in the forms shown in Fig. 70. Some little skill and experience is generally necessary in order to obtain good results.

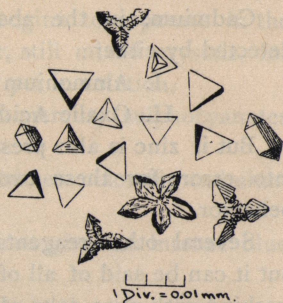


Fig. 70.

* Anleitung, 2. Aufl. p. 52.

Exercises for Practice.

Try precipitating Zn in acid, neutral and ammoniacal solutions.

Test mixtures of Zn and Cd, first in neutral, then in ammoniacal solutions.

Experiment with Zn in the presence of the interfering elements noted above.

CADMIUM.

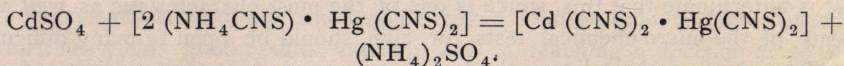
Cadmium, in the absence of zinc, can be very easily and satisfactorily detected by either:

- I. Ammonium Mercuric Sulphocyanate, or
- II. Oxalic Acid.

But if zinc is also present, great care must be exercised to avoid being led into error, for these two elements are very much alike in their chemical behavior.

Several other reagents have been suggested for the detection of cadmium, but it can be said of all of them that the results are not satisfactory, even when working with pure salts of cadmium, and that they fail completely when dealing with complex mixtures.

I. Cadmium forms, with Ammonium Mercuric Sulphocyanate, a Double Sulphocyanate of Cadmium and Mercury.



Method.—Proceed exactly as directed under Zinc, Method I, avoiding an excess of the reagent. Long, highly refractive prisms separate. (Fig. 71.)

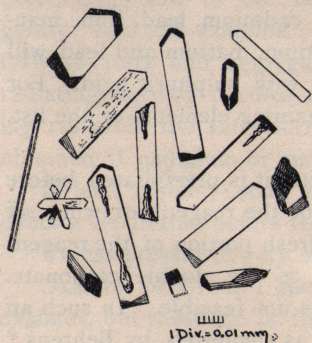


Fig. 71.

The appearance of these prisms varies with the conditions which obtain at the time of their formation, as, for example, the concentration, depth of the test drop, amount of reagent added, acidity, etc. These variations are, however, not of a kind to render the test doubtful; long prisms, either singly or in groups, being the rule.

Remarks.—The remarks made under zinc are applicable to cadmium in every case.

The double sulphocyanate of cadmium and mercury is more soluble than that of zinc, hence the reaction is slower and more concentrated solu-

tions should be employed.

If a small amount of zinc is also present, mixed crystals containing zinc and cadmium first separate whose crystal form can be described as non-feathery skeletons; soon after this the cadmium double salt separates in its usual form. In order that this sequence shall be brought about, it is best to employ a solution somewhat more dilute than when zinc is absent. Much zinc usually prevents the formation of any of the prismatic crystals of the cadmium salt, only mixed crystals resulting.

Traces of copper color the cadmium crystals a faint chocolate brown; this brown color intensifies with an increase in the amount of copper. When considerable copper is present, the copper double salt first separates, since it is slightly less soluble than the cadmium compound; then mixed crystals form, in which the copper apparently predominates over the cadmium. These mixed crystals are of a deep bluish-green color. By this time most of the copper and but little of the cadmium has been precipitated, and the concentration has also reached such a point that the cadmium double salt begins to separate in the crystal forms shown in Fig. 71. These are, however, still mixed crystals, for they are colored brown by the small amount of copper yet in solution.

It is improbable that these brown copper-cadmium-mercury sulphocyanates are isomorphous mixtures.

As in the case of the zinc reaction, iron may sometimes color the cadmium salt a reddish brown.

Cobalt colors the cadmium salt blue. Much cobalt gives an intense blue color and alters the crystal form.

Magnesium and aluminum have even less effect than in the case of zinc.

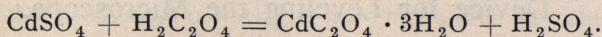
Before testing for cadmium with the sulphocyanate reagent, it is best to first remove any lead or silver which may be present.

See also remarks under Zinc, Method I.

Exercises for Practice.

Experiment with salts of cadmium in the manner suggested under "Zinc," trying all the exercises mentioned, but having cadmium as the element in excess instead of zinc.

II. Oxalic Acid added to solutions of salts of Cadmium precipitates Cadmium Oxalate.



Method.—To the test drop add a solution of the reagent by the flowing in method. Clear, colorless monoclinic prisms and tabular crystals separate, either singly, in Xs, or in clusters. (Fig. 72.) The tabular crystals have the appearance of rhombs and rectangles.

Frequently very concentrated solutions yield crystals having an octahedral aspect.

Remarks.—The solution to be tested should be neutral or only slightly acid, and rather concentrated with respect to cadmium.

Dilute solutions fail to give good results.

The typical crystals of cadmium oxalate are seen only when working with almost pure salts of this element.

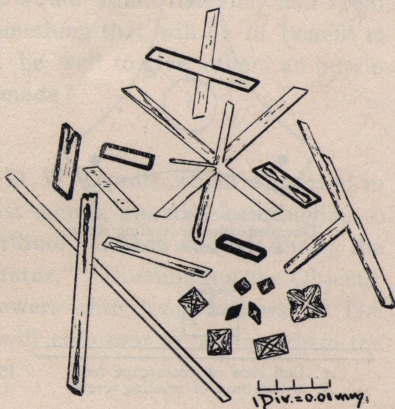


Fig. 72.

In the presence of zinc, only the forms of zinc oxalate are usually obtained.

Members of the calcium group and lead are first removed with sulphuric acid and a trace of alcohol. Silver with hydrochloric acid.

In the presence of copper, aluminum, iron, manganese, chromium, nickel and cobalt, the reaction with oxalic acid is not reliable and in most cases worthless.

Treated with ammonium hydroxide in the manner described under Zinc, cadmium oxalate recrystallizes in the form of rods and tables. This method of procedure is often of value in arriving at a decision as to the nature of a precipitate obtained with oxalic acid. Unfortunately, zinc prevents the formation of these rod-like crystals.

Exercises for Practice.

Test a pure salt of Zn in dilute and in concentrated solution. Repeat the experiments, substituting Cd for the Zn.

Make a preparation of $\text{ZnC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$; draw off the supernatant liquid; add NH_4OH ; warm gently and study the preparation. Prepare slides of different degrees of concentration.

Recrystallize $\text{CdC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ in the same manner as the Zn salt.

Test mixtures of Zn and Cd.

Recrystallize the mixed oxalates from NH_4OH .

Make mixtures of Zn and the interfering elements listed above. Treat the precipitated oxalates with NH_4OH . Then try Cd in the same manner.

Try precipitating Zn with HKC_2O_4 , $\text{K}_2\text{C}_2\text{O}_4$, $(\text{NH}_4)_2\text{C}_2\text{O}_4$, etc. Then try Cd in like manner.

E. M. CHAMOT.

Cornell University.

Device for Leveling the Microscope.

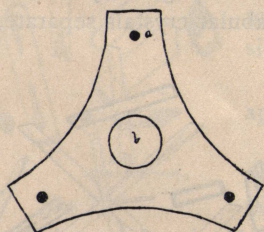
In examining objects in liquids on the stage of a microscope, the want of true level annoys by keeping up currents and displacing, often disastrously, the object sought.

By this simple and inexpensive device all this trouble could be overcome.

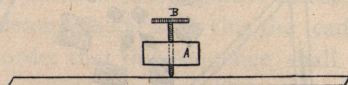
One need not even add the expense of a small "spirit" level; for a glass slip on which are placed a few drops of water containing particles of opaque material which would render any tendency to current motion visible, will answer the purpose.

Place this trial slip on the stage, and level by means of the three screws until no currents are perceptible.

T. O. REYNOLDS.



MICROSCOPE FOOT.
a. Threaded hole for leveling screw.
b. Microscope pillar.



A. End view of microscope foot.
B. Milled head of leveling screw.

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 and
Laboratory Methods.

Edited by L. B. ELLIOTT.

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the work of the summer and balance up our accounts before opening those of the coming year. By many the vacation is taken as an opportunity to do original work in some summer laboratory; others leave their own laboratories for the purpose of securing recreation and pleasure; but teachers, wherever they go, seldom forget the work that is before them, and are constantly alert for methods and improvements in the study or presentation of their subject. Visits to strange laboratories and contact with new minds give new and valuable suggestions for work. These should be allowed to pass the clearing house, and their helpfulness made as general as possible.

The suggestions you have received from some other worker in your field, the improvement you have made in your method of work at the summer or field laboratory, may seem of little importance to you, but may, if allowed to circulate, come to the hands of some who need just what you have to give.

If, on the other hand, in your work you have met a difficulty which you have been unable to solve, through the clearing house you may expect to receive an answer to your question.

No doubt there are few of our readers who would admit that they had spent the entire summer without having learned something that will be of benefit to them during the coming year. Would it not be well to give others an opportunity to profit by the advancement you have made?

* * *

THE article on Photo-micrography, by Dr. D. W. Dennis, which appeared in the Department of Laboratory Photography last month, was the introduction to a series of articles which the author will contribute on that subject during the coming year. The series will include "Apparatus," "Illuminating the Object," "Focusing for very high and very low powers with long bellows," "The Negative and Positive," etc., and the author will endeavor to put into them the most valuable things now known on the subject.

CURRENT BOTANICAL LITERATURE.

CHARLES J. CHAMBERLAIN.

Books for review and separates of papers on botanical subjects should be sent to
Charles J. Chamberlain, University of Chicago,
Chicago, Ill.

REVIEWS.

Wettstein, Dr. R. von. Handbuch der Systematischen Botanik. 1: v. + 201. Figs. 762, in 128 plates. Franz Deuticke, Leipzig, Germany, 1901. 7 marks.

This volume deals with those plants which are usually termed Thallophytes. A second volume, which will

be ready some time within the next year, will treat the Bryophytes, Pteridophytes and Spermatophytes, which the author will describe under the term, Cormophytes. It is the purpose of the book to give a comprehensive view of plant forms with particular reference to development and phylogeny. This purpose is accomplished by a full presentation of the larger divisions and by giving the developmental history of a large number of the more important types.

The book is intended for those who would know systematic botany from the phylogenetic standpoint, but it will also be very helpful to those who need such a taxonomic background for morphological and citological work. While the author is indebted to other taxonomic works, and especially to Engler and Prantl's *Die Natürlichen Pflanzenfamilien*, the work is by no means a compilation. A chapter on the history of taxonomy gives a brief summary of the systems of Jussieu, A. P. DeCandolle, Endlicher, Brogniart, A. Braun, Eichler, and Engler.

In a phylogenetic classification many things must be considered and it is not always easy to decide whether a plant is high or low in any particular respect. In general, the lines of advance are the same as those given in *Die Natürlichen Pflanzenfamilien*. The possibility of a polyphyletic origin must be admitted because it is known that similar life conditions tend to produce similar morphological structures. The fossil record shows that Angiosperms are more recent than Gymnosperms and Pteridophytes, and that Pteridophytes are older than Gymnosperms, but the record is too fragmentary to be of much importance in determining the relative positions of smaller divisions. Comparative morphology must be the principal basis for classification. The evidence of geographical distribution, of rudimentary organs, monstrous forms, juvenile forms and anatomical details must be weighed, and it must be remembered the ontogeny of a form may give useful hints as to its phylogeny.

The first forty-five pages are occupied by a discussion of the principles of classification; the rest of the book is devoted to plants which are usually designated as Thallophytes. These comprise six genetic lines (Stämmen) between which it is not possible at present to demonstrate relationships, although such may exist. The lines are *Myxophyta*, *Schizophyta*, *Zygophyta*, *Euthallophyta*, *Phaeophyta* and *Rhodophyta*. The term "Algæ" is usually applied to the independent members of these groups, and "Fungi" to the parasitic and saprophytic forms. Each group with its orders and families is clearly characterized and the

life histories of typical forms are thoroughly illustrated. The most important genera and the commonest species are often mentioned, so that while the book does not pretend to be a manual for the identification of genera or species, it nevertheless serves this purpose in many cases. The large number of excellent illustrations, together with the clear style in which the book is written, afford the English speaking student a good opportunity for improving his German while increasing his knowledge of Algæ and Fungi.

C. J. C.

Bernard, Ch. Recherches sur les sphères attractives chez *Lilium candidum*, *Helosis guayanensis*, etc. Jour. de Botanique 14: 118-124, 177-188, 206-212, pls. 4-5, 1900.

For the past five or six years many investigators have denied the existence of centrosomes in the higher plants, while other investigators, working with

practically the same material and employing the same methods, have insisted that the centrosomes are present. Prof. Bernard has examined *Lilium candidum*, *L. Martagon* and *Helosis guayanensis* and has convinced himself of the presence of these much discussed structures. Material was fixed in alcohol and in Fleming's solution and was stained in a mixture of fuchsin and iodine green (1 per cent. aqueous solution of fuchsin, 2 parts; 1 per cent. aqueous solution of iodine green, 2 parts, and water 40 parts). The safranin-gentian-violet orange combination did not give as good results. In *L. candidum* the centrosomes were found quite regularly during various phases in the germination of the megaspore. They resemble the structures described by Guignard, but are not so sharply defined. The centrosome was also identified in the gametophytes of *Helosis*. In *L. Martagon* centrosomes were found in the female gametophyte, in the vegetative cells of the ovule, but could not be positively identified in the endosperm. The centrosome is cytoplasmic in origin.

Incidentally, it is noted that there are sometimes two embryo sacs in *L. candidum*. In this species a very large vacuole develops between the two polar nuclei, preventing the nuclei from fusing. The writer suggests that this may account for the sterility of this species. It is also noted that the upper polar nucleus and the nuclei of the egg and synergids are erythrophilous, while the four nuclei at the antipodal end of the sac are cyanophilous. This difference in chromatophily is attributed to chemical differences due to sexuality, the nuclei at the antipodal end of the sac having lost all sexual character.

C. J. C.

Chodat, R., and Bernard, C. Sur le sac embryonnaire de *Helosis guayanensis*. Jour. de Botanique. 14: 72-79, pls. 1-2, 1900.

Comparatively little is known of the embryology of the Balanophoraceæ, but it is certain that they have puzzling

peculiarities. Writers agree that there is no ovule or placenta in *Balanophora*, but that the megaspore is situated in a tissue at the base of a prolongation incorrectly termed a "style." Van Tieghem (1896) found that in *B. indica* the polar nuclei do not fuse and that fertilization occurs at the antipodal end of the sac as often as at the upper end. According to Treub (1898), in *B. elongata* the megaspore germinates in the usual manner. The polar nuclei, however, do not fuse, but each divides independently. The egg apparatus breaks down and there is no fertilization, but an embryo develops from one of the cells of the endosperm. Lotsy (1899) investigated *B. globosa* and supported Treub in every particular, including the peculiar origin of the embryo.

In the present paper, Chodat and Bernard give the results of their work on *Helosis guayanensis*. The archesporial cell becomes the megaspore directly without cutting off a tapetal cell or giving rise to a row of potential megaspores. The jacket or "tapetum" surrounding the embryo-sac is sporogenous tissue. The two daughter nuclei resulting from the first division of the nucleus of the megaspore are quite different in appearance, the one at the upper end of the sac staining much more deeply. This nucleus gives rise to the egg, two synergids and a polar nucleus in the usual manner. The other nucleus stains faintly and rarely divides at all, but soon degenerates, so that no antipodals or polar nucleus are formed. According to Van Tieghem the egg is fertilized in *Helosis* and *Balanophora*. The present writers find that in *Helosis* the egg becomes large, but also becomes weak and feeble in appearance, so that, while they were not able to prove or disprove the occurrence of fertilization, they believe that the feeble condition of the egg, together with the position of the embryo in the endosperm, favor Treub's view that the embryo arises apogamously from the endosperm.

C. J. C.

CYTOLOGY, EMBRYOLOGY, AND MICROSCOPICAL METHODS.

AGNES M. CLAYPOLE, Cornell University.

Separates of papers and books on animal biology should be sent for review to
Agnes M. Claypole, 125 N. Marengo avenue,
Pasadena, Cal.

CURRENT LITERATURE.

Hoffman. Die Rolle des Eisen bei der Blutbildung. Zugleich ein Beitrag zur Kenntniss des Wesens der Chlorose. Virchow's Arch., 160: 235-306, 1900.

The efforts of the author were directed to the investigation of the so-called blood forming organs, and were laid in

the following lines: Enumeration of the blood corpuscles; determination of the hemaglobin; tracing the manner in which the metal is taken into the organism; the effect of different preparations; the effect in healthy and anæmic animals, etc. Ninety-eight rabbits in all were used in the investigation. To determine whether the entrance of the metal into the so-called blood forming organs could be proved, the bone marrow, spleen, and the mesenteric lymph glands were examined for their contained iron. The liver and kidneys were usually similarly tested. The bone marrow was taken out as entire columns of $\frac{1}{2}$ -1 cm., depending on the size of the animal, from the humerus, radius, femur, and tibia, and put, as were the other tissues, into 70 per cent. alcohol to which 5 per cent. solution of ammonium sulphide was added, then after 24 hours into absolute alcohol plus a few drops of sulphide. In all animals containing iron the marrow became after one-half or more hours, of a gray black, then of a distinct green color. This was especially clear to the eye if the tissues were compared with some from an animal not containing iron. Since, for the most part, parallel investigations were made on both iron and non-iron fed animals, it was easy to determine macro-

scopically, in a few hours, with certainty from which rabbit the piece of marrow was taken. Moreover, the marrow of the non-iron fed animal lost much of its reddish color, passing into a dirty red, yet never acquiring the looks of the sulphide of iron preparation. The spleen always, after a term of feeding with iron, was the quickest to color, becoming dark green in a few minutes. This was sometimes true in animals which had received no iron, but the difference in the intensity of the reaction was a ready means of distinction between the animals with and without iron. The mesenteric glands also showed the same difference, taking in iron-fed animals a clear green tone, which became much lessened, or entirely absent, in iron free cases. The pieces of tissue were hardened 24 hours in absolute alcohol, embedded in paraffin, sectioned in different regions, and fastened with albumenized glycerin on the slides; paraffin dissolved out with xylol, and the sections placed for an hour or so in ammonium sulphide, washed rapidly in distilled water, and mounted in glycerin. In every iron-fed case, in the bone marrow the iron is readily distinguished, especially in thin sections. The iron laden transporting cells, diffusely green, have two to five black green granules. Usually these cells are most abundant in the red marrow, at the ends of the bone, apparently less abundant in the yellow fatty marrow, though absolutely more. To study the exact position of these iron cells, the author made preparations after Stieda's method, that is, Berlin blue with alum carmin. The bone marrow of the animals not fed with iron was practically iron free. The spleen of the ordinary plant fed rabbit contained a fair amount of iron, contained exclusively in the pulp. The amount after feeding with iron rose to such a degree that the sections became stained deep green in a second, only the follicles appearing as light, unstained spots. In the mesenteric lymph glands, on ordinary food, solitary green leucocytes can be found; after an iron diet their number increases in a marked degree. The liver in young animals gives no iron reaction without feeding the substance, but in older animals a small amount is usually indicated. On feeding iron these assume, more slowly and to a less degree than the spleen, the characteristic color showing the presence of iron. This is especially true in the portal regions. The kidneys, only here and there, even with large doses of iron, show single green epithelial cells in the convoluted portions. On the contrary, pieces of the small intestine and colon washed in and left in ammonium sulphide for a short time become green to deep blackish green. The large intestine always gives the strongest reaction.

The enumeration of the red corpuscles and determination of the hemaglobin were also made. Cover-glass preparations were stained with Ehrlich's hæmatoxylin and eosin solution. Sections of bone marrow were hardened in alcohol of increasing strength, embedded in paraffin, and stained with eosin-hæmatoxylin, and alum carmin. The spleen and mesenteric glands were similarly treated. For investigation of the special kinds of cells in the bone marrow, Neumann's process was discarded. It was to crush a piece of bone and receive the exuded marrow pulp into a capillary tube, and bringing very small drops from this on to the cover-glass. The author did not employ this method because it seemed to him that marrow cells, as well as the contents of the larger and smaller blood vessels, were obtained. The author arrived at the quantitative relation of the

mature non-nucleated erythrocytes to the nucleated red corpuscles and the remaining marrow cells by taking, with a fine pair of scissors, as nearly as possible equal amounts of marrow about the size of a pin head, and very carefully pressing them evenly between two clean cover-glasses. With the very cellular lymphoid marrow of the anæmic animal this was always successful, giving a thin smear, a little thicker in places where fibrin lay about heaps of cells, which did not interfere in a general view over the preparation. The air-dried cover smears were fixed in an alcohol and ether mixture, and stained with Ehrlich's eosin-hæmatoxylin solution or the triacid stain. In the same manner preparations were made of spleen and in a few cases of the lymph glands also. E. J. C.

- * **Danjeard, P. A.** Nuclear division in Protozoa.
Le Botaniste 7, 1900. Extract from Royal
Mic. Jour. April, 1901.

In this paper the author takes exception to the usual statement that nuclear division in Protozoa is invariably direct.

Figures and descriptions of ordinary division as shown in *Amœba polyopodia* are given; that of *Amœba crystalligera*, in which the dividing nucleus is drawn to a thread at the division plane; in *Sappinia pedata* in which the nucleus divides twice without cytoplasmic division; finally a full account of the process of division in *Amœba hyalinia*, sp. n., in which no karyokinesis occurs. In this form the nucleus contains a large nucleolus which breaks up at the onset of division and appears to give rise to chromosomes. Some parts of the nucleolus also mingle with the nucleoplasm and give it chromatic properties. This nucleoplasm forms a spindle in which very fine chromosomes arrange themselves in an equatorial plate. Later they separate and approach the poles of the spindle. The spindle is pulled out as they do this, which process is continued as the chromosomes migrate to the poles of the elongating amœba, until but elongated threads remain to represent the spindle. The author holds this as proof that the chromosomes migrate by their own activity here as elsewhere; since in the present case no spheres exist and the movement of the chromosomes continues after the poles of the spindle have been reached, the threads of the latter cannot be active agents. As the new cells separate, the chromosomes round themselves off and form the nucleolus, the spindle remains, constituting the surrounding nucleoplasm. This is clearly a karyokinetic process, but in the author's opinion its simplicity shows that the evident process is merely a modification of the simpler direct division, special emphasis being laid on the conditions occurring in *Amœba crystalligera*.

A. M. C.

- Penard, E. Dr.** Experiments in Diffugia,
Rev. Suisse Zool, 8, 1900. Ext. from Jour.
Roy. Mic. Soc., April, 1901.

Dr. Eugene Penard has succeeded in separating the nucleus intact from the cytoplasm in several cases, three of

which were accomplished without any other material injury to the organism. Such separate nuclei appear healthy for 9 to 24 hours after removal, but they ultimately die apparently of inanition. The non-nucleated portions, however, lived and moved about for several days apparently none the worse for the operation. In three cases the specimens were killed for examination and consisted to all appearances of normal protoplasm. Non-nucleated animals were not seen to take food, but since intact forms can remain without food for weeks uninjured there seems no doubt that the mutilated specimens could digest food. A. M. C.

CURRENT ZOÖLOGICAL LITERATURE.

CHARLES A. KOFOID.

Books and separates of papers on zoölogical subjects should be sent for review to Charles A. Kofoid, University of California, Berkeley, California.

Howard, L. O. Mosquitoes. 241 pp., with 50 figs. in the text. New York, 1901. McClure, Phillips & Co. \$1.50.

The popular interest in mosquitoes, growing out of the discovery of their agency in causing malaria and yellow fever, makes this book of Dr. Howard's very timely. The author describes the life history, the feeding, breeding, and living habits, and the transformations of mosquitoes. The method by which malaria, yellow fever, and filariasis are transmitted to man, and the species concerned in this process, are carefully described. American mosquitoes are also discussed, and a key to all of the known species is given. Suggestions are giving for breeding and rearing the larvæ, and directions for collecting and preserving specimens for examination and for museum purposes are detailed. Means of extermination of these pests, and the precautions necessary to prevent the spread of disease by them, are given in the light of recent experiments. This book should find its way into every high-school library, and will be of value to physicians and travellers. Chapter IX, "How to Collect and Preserve Mosquitoes," is reprinted herewith by courtesy of the publishers.

C. A. K.

"Adult mosquitoes are very fragile creatures. The scales upon their bodies and legs are easily rubbed off, and the antennæ, and especially the legs, break with the least handling. Even in their ordinary course of life the scales rub off, and with certain species an adult which is two or three weeks old is quite different in appearance from one which has just emerged from the pupa. Practically, they cannot be handled with the fingers, or their value as cabinet specimens or as specimens for study is lost. With some forms there are important characters in the arrangement of the scales on the thorax. With others the scales on the wing are of importance, and if the front legs are accidentally broken off, an important character to which I have referred in the systematic portion of this book as existing in the claws of the fore feet, is naturally unavailable. In capturing them, therefore, they must not be handled, and I have found the most satisfactory method of capture to consist in simply placing a small, open-mouthed vial over the mosquito while at rest. On the wing, it cannot be caught, even with a delicate net, without rubbing or leg-breaking. If a mosquito lights upon your hand, or upon a twig, or a leaf, or upon a wall of a room, it is quite easy, especially if it be engaged in sucking blood, to cover it adroitly with the vial. It rises almost instantly, and the mouth of the vial is plugged with a plug of absorbent cotton. A drop of chloroform on the cotton will stupefy the specimen almost immediately, and another drop will kill it.

The specimen may be kept permanently in the vial, and when studied, if the study goes no further than an examination of the coarser characters. In an attempt to determine the species, it will often suffice gently to slide it out upon a sheet of white paper and examine it with a powerful hand-lens. With the one-quarter inch achromatic triplet lens, made by different firms, I have found it possible to distinguish all of the generic and specific characters, even down to the teeth of the tarsal claws. This, however, is difficult to persons not accustomed

to the use of high-power hand lenses, and in such instances one must break off a tarsus and mount it upon a slide in glycerin or Canada balsam for examination under a compound microscope.

It is not advisable to mount adult mosquitoes bodily on slides in any medium whatever. They should not be preserved in alcohol or formalin, but should be kept dry in vials. Of course they will rattle around somewhat, and there is danger that the legs and the antennæ will be lost; therefore, if they are moved from the vial after the collecting and killing, into pill boxes with cotton, they can be carried safely, or can be sent in the mails. Several of the pill boxes may be placed inside a tight tin or wooden box and mailed with perfect security.

A collection of mosquitoes should, however, not be kept in this way, provided that it is intended as a study collection. The method which I have adopted, and which is the one customarily used for small insects that are not too small for hand-lens work, is the triangular-tag method. Take a sheet of stiff paper or very thin cardboard, and cut a strip say five-sixteenths or three-eighths of an inch wide. Then from this strip, by slightly oblique cuts, cut a series of triangles that will be pointed at the tip and a little less than an eighth of an inch wide at the base. Through the base of the tag may be run an insect pin, and to the tip the mosquito should be glued, white or yellow shellac being the best medium for the gluing. The mosquito should be glued on its side, just behind one wing, so that its back is away from the pin. This enables one readily, by holding the point of the pin in one's hand, to examine with a lens, all legs, antennæ, palpi, one side, and the back. The tag should be pushed up on the pin until it is from two-thirds to three-quarters of the length of the pin away from the point. To the lower part of the pin should be attached a small label giving date, exact locality, and name of the collector, and below this may be pinned another small label bearing the name of the insect.

Those who for some reason do not like the paper triangle method of mounting, use very minute pins, made by Mueller in Vienna, and known as "*minuten insekten naedeln*," which are sold by Queen & Co., Philadelphia, and other large dealers in such things. These pins are so small and delicate that they must be thrust through the thorax of the mosquito and into a little strip of cork, the cork strip itself being pinned upon one of the larger and longer insect pins.

Some collectors, instead of using the chloroform method of killing, prefer the cyanide bottle. The cyanide bottle is made by taking a wide-mouthed flask, putting a small lump of cyanide of potassium at the bottom, and covering it with a layer of liquid plaster of Paris, which, when allowed to set, makes a complete layer over and around the cyanide, and prevents the water that comes from the deliquescence of the cyanide from injuring specimens that are placed in the vial, but which at the same time is sufficiently porous to permit the escape of the deadly cyanide fumes. Even with the layer of plaster of Paris, however, the cyanide bottle will sometimes become wet, so that a bit of blotting-paper may with advantage be inserted to cover the plaster of Paris, and to absorb the superfluous moisture. A mosquito captured in one of these cyanide flasks dies very quickly, and is in good condition for dry mounting or for transfer to pill boxes. The cyanide bottle is, preferably, stoppered with a cork stopper, but rubber stoppers are also used.

In collecting early stages of mosquitoes, it is only necessary to have a supply of bottles, a little coffee-strainer with a handle, and a large reading glass. Other apparatus is cumbersome and unnecessary. I have a large reading-glass four inches in diameter, with a strong handle, which I find very useful in examining the surface of water-pools, especially for *Anopheles* larvæ. The dip-strainer used is an ordinary cheap coffee-strainer, which has been mounted upon a long handle, so that one can reach out two or three feet from the shore and capture larvæ and pupæ. Other large strainers with a fine mesh are sold at the hard-

ware stores, and may be purchased cheaply. In bringing larvæ and pupæ in from the field, too much jarring about in a bottle may result in their death by drowning. It is desirable, therefore, to put moss or water-weed in the bottle with a minimum of water, provided the insects are transferred to an aquarium or a still jar within a few hours.

Nuttall, Cobbett, and Strangeways-Pigg, who have done a great deal of collecting of mosquito larvæ in England, as shown in one of their important papers, entitled "Studies in Relation to Malaria," published in the *Journal of Hygiene*, Vol. 1, No. 1, January, 1901, used as their collecting apparatus some wide-mouthed bottles of medium size with cork stoppers; a white enamelled dipper which, when required, can be tied with a piece of twine to a long bamboo rod; a small pipette with a rubber bulb, and small vials containing dilute alcohol for the preservation of larvæ which they did not wish to keep alive. They travelled over England on their collecting trip on bicycles. When the larvæ or eggs were captured in the porcelain dippers they were removed with a pipette and put in bottles, which were half filled with water, wrapped in cloths, and attached to the bicycle frame. They found that they could be transported for several hours without injury. They noted also that the large larvæ did not withstand the shaking as well as the small ones, but that a sufficient number could always be brought back for studying purposes. On expeditions lasting a couple of days, they took precaution to remove the corks occasionally to give the insects fresh air. White dippers were used, since they could more easily detect the eggs or larvæ on the white background, and they found that only rarely could they detect the insects by direct inspection of the surface of the water.

Larvæ and pupæ, when it is desirable to preserve them in these stages, and it is always desirable to keep a small set of each species, may be kept in vials of alcohol or dilute formalin (5 to 10 per cent.). When preserved in alcohol they should be passed through different strengths, beginning with a weak mixture, in order that they may not shrivel; or, what is still better, kill the larvæ or pupæ suddenly in a cyanide bottle, then bring the water nearly to the boiling point in a little porcelain dish over an alcohol lamp, and drop the insects in, leave them until the boiling point is just reached, and then remove them. An immersion of only a few moments will suffice. Ordinarily the larvæ will sink at once to the bottom of the water, and very soon thereafter rise to the top. This rising is an indication that the specimen should be removed at once. The specimen may then be preserved in ordinary commercial alcohol, and will retain perfectly its color and shape. This method is used successfully with the larvæ of many insects. It is not necessary to mount either larvæ or pupæ whole on slides. One of these preserved specimens can be put in a cell with alcohol or glycerin and studied under a low power with perfect ease, and the examination of minute details of its anatomy, external and internal, may readily be accomplished by dissection, and the parts dissected out mounted permanently on slides in any of the ordinary media.

In rearing different species of mosquitoes I have had perfect success in the use of large, cylindrical glass jars, known as battery jars. They can be bought in almost any city, and of various sizes. The size which I find most convenient will hold about a gallon of water. A layer of sand an inch or two deep is placed in the bottom of the jar and a quart or more of water poured over it. After the sand has settled and the water has cleared, a bit of almost any small water-plant may be inserted to advantage, provided mosquitoes of the genus *Culex* are being reared. If the experiment is with *Anopheles*, however, some fresh-water alga is introduced, such as *Spirogyra*, *Mougeotia*, *Œodogodium*, *Cladophora*, or *Oscillaria*—almost any green scum from stagnant water, in fact. Over the top of the jar is placed a piece of swiss, or other fine, translucent cloth, held down by a large rubber band.

The eggs of *Culex* may be had with ease by exposing a bucket of water out of doors in a mosquito locality on almost any summer night. If the egg masses be transferred from the bucket to the prepared breeding-jar, the growth of the larvæ can be watched, and their transformations can be observed with perfect ease. Occasional specimens can be taken out and preserved, to illustrate variations of different stages of growth. Accurate notes can be kept as to temperature, periods of transformation, and so on. A series of dates, provided several jars are under observation, can be written from time to time upon a slip of paper, which may be pinned to the edges of the cloth covering of each jar.

Where the eggs of *Anopheles*, for example, have not been found, females collected at large may be liberated in such a prepared breeding-jar. They will rest on the under side of the cloth covering during the day, and at night will lay their eggs on the surface of the water. It is desirable to have a stick in the water, or a leaf, or a bit of cork floating on the surface. I have had no difficulty in obtaining the eggs of *Anopheles* in large numbers in this way, and the eggs of *Culex* as well, but although as many as fifty females of *Psorophora* have been liberated in breeding-jars prepared in this way, I have not been able to get the eggs of this genus, which, as a matter of fact, are yet unknown. It is possible that *Psorophora* does not deposit its eggs upon the surface of water. This, however, is unlikely, and it is rather to be supposed that the females used in my experiments were not old enough for oviposition, and died from the confinement of the jar before the egg-laying period arrived.

When one wishes to study closely the movements and intimate habits of the early stages of mosquitoes, a great deal may be observed through the glass sides of the jar, by using a coarse lens and studying those near the side, but when a closer study is desired, individual larvæ or pupæ may be lifted out with a strainer and put in a shallow porcelain vessel, where they can be watched with ease under a dissecting microscope. *Anopheles* larvæ may be studied in this way very easily, and no nature study could be of more fascinating interest than the observation of these creatures, lying as they do with the body practically in a single plane, so that they may be easily watched, with the mouth parts in constant action, and the head occasionally turning upside down, and the reverse, with lightning-like rapidity."

C. A. K.

NORMAL AND PATHOLOGICAL HISTOLOGY.

JOSEPH H. PRATT.

Harvard University Medical School, Boston, Mass., to whom all books and papers on these subjects should be sent for review.

Sailer, J. Primary Endothelioma of the Left Superior Pulmonary Vein. Contributions from the William Pepper Laboratory of Clinical Medicine. Philadelphia, pp. 416-444, 1900.

At the orifice of the left superior pulmonary vein there was a dense mass of fibrous tissue, almost occluding the lumen, and extending on the auricular

wall to the upper end of the left inferior pulmonary vein. The wall of the superior pulmonary vein was nearly uniformly thickened throughout its whole course in the upper lobe, forming a round cord fifteen mm. in diameter. Upon section it was seen to be made up of grayish and yellowish tissue. The upper lobe was contracted, pigmented and airless.

There was found, on microscopical examination of the thickened vein, hyperplasia of the connective tissue stroma and enlargement of the lymphatic spaces

and of the vasa vasorum. The peculiar feature was the proliferation of the endothelial cells in these spaces. The writer regards the process as a primary endothelioma, although he admits that it may be simply the result of chronic inflammation. There is an excellent résumé of the literature of endothelioma.

J. H. P.

MacCallum, W. G. On the Intravascular Growth of Certain Endotheliomata. Contributions to the Science of Medicine, dedicated by his pupils to Dr. W. H. Welch. Baltimore, pp. 497-509, 1900.

MacCallum studied a malignant tumor, originating in the left testicle, which he designates lymphendothelioma testis.

The primary tumor formed a nodulated mass about 6x5 cm. in size. It was succulent, myxomatous in places and variegated in color by opaque yellow areas of necrotic tissue. Death occurred four months after the removal of the testicle. The growth had extended from the scrotum in a remarkable manner. The spermatic vein was packed with a somewhat cylindrical tumor mass which extended upward through the left renal vein into the vena cava, in which it spread out into a bunch of translucent villus-like processes which extended throughout the whole length of the vena cava and projected into the right auricle. These curious formations resembled the villi of hydatidiform moles. Similar bundles were also found in the pulmonary arteries and in the pulmonary, jugular and subclavian veins. The lungs, liver, intestine and brain contained tumor nodules and there were local recurrences in the scrotum and groin which formed a chain leading up to a large tumor mass in the lumbar region. The tumor nodules in the lungs and liver were rounded and rather sharply outlined; many were semi-translucent and appeared to be made up of small cysts, others were more opaque and consisted of very soft, succulent, whitish tissue.

Histologically the neoplasm consisted of a framework of soft myxomatous tissue which contained cysts and tubules of various sizes and shapes. These spaces were lined with cells which varied in height from a flat, scale-like form, exactly resembling the endothelium of the lymphatics, through all gradations to high columnar epithelium-like cells. In places the cells were piled up two or three rows deep and arranged in folds and papillary masses which had invaded the surrounding tissue and finally had broken their way into the veins. The intravascular growths were covered by the endothelium of the veins, just as an organizing thrombus would be covered, and continuing in their development they formed papillary masses which projected along the lumen of the vein and occasionally formed secondary attachments to the walls. Passing through the heart into the pulmonary arteries, these masses became attached to the walls of the finest arterioles, and breaking through these gave rise to the secondary tumor nodules in the lung. The nodules in the liver, brain, and intestine were probably tertiary in origin.

The cyst-like spaces found in the metastases and intravascular masses, as well as in the primary tumor, were lined by cells which do resemble epithelial cells and have been regarded as epithelial in nature by the few other investigators who have studied this type of tumor. MacCallum, however, in view of the facts—(a) that no connection with the well defined epithelium of the seminal

tubules nor with any other epithelial structure can be traced; (b) that the morphology of such cells, as shown by Volkmann, Krompecher, and others, is of very slight importance in their identification with epithelial or endothelial structures; (c) that direct transitions between the obviously connective tissue elements of the stroma and these cells occur; (d) that intercellular fibrils can be demonstrated between the cells of such masses by the use of Van Gieson's stain; and (e) that the spaces in which such cell masses occasionally lie have not, like the alveoli in carcinomata, any further lining endothelium—concludes that it is justifiable to consider these cells of endothelial rather than of epithelial nature. Hence he classes the tumor as an endothelioma, rather than a carcinoma.

J. H. P.

GENERAL PHYSIOLOGY.

RAYMOND PEARL.

Books and papers for review should be sent to Raymond Pearl, Zoölogical Laboratory, University of Michigan, Ann Arbor, Mich.

Weinland, E. Zur Magenverdauung der Haifische. Zeitschr. f. Biol. 41: 35-68, Taf. I, 1901. This paper treats in considerable detail of the digestive processes and functions of the anterior part of the alimentary

tract in the selachians. As living material individuals of the following species were used: *Scyllium catulus* and *canicula*; *Torpedo ocellata* and *marmorata*; and *Raja asterias*, *clavata* and *glauca*. The chemical reactions of the stomach contents were also studied in dead specimens of a number of other species. The method used for obtaining the secretion of the gastric glands in a pure condition from the living animal is ingenious and seems to have given excellent results. Briefly, the procedure was as follows: one end of a glass siphon of from 10 to 15 mm. diameter was thrust down through the mouth well into the cavity of the stomach, and allowed to remain there until a sufficient amount of the fluid contents of the stomach had passed out. Meanwhile artificial respiration was maintained by passing a current of water over the gills. The œsophagus closed tightly over the siphon so that there was no risk of any mixture of sea water with the stomach contents. The treatment apparently has no ill effect on the animal, as the author states that he has in some cases daily emptied the stomach of the same animal by this method for considerable periods of time (fourteen days and over), without causing any injury. This method should be widely applicable, both for purposes of investigation and class demonstration.

The principal points discussed are: (1) the length of time the food remains in the stomach, and (2) the chemical reaction of the stomach contents. It was found that the food remains in the stomach for a considerable time; from two to three days in the majority of cases, up to eighteen days in one instance observed. The food is generally completely disintegrated in the stomach, forming a fluid or semi-fluid mass. The animals studied were able to live for several months at a time without taking food.

It appears clearly from the experiments that in the living skate (*Raja*) the

reaction of the stomach may be either acid or alkaline, both during digestion and when empty. The reaction is influenced by the nature of the food. For example, when the animals are fed crabs the reaction of the stomach contents is alkaline, while with fish as food the reaction is almost invariably acid. In the species of *Scyllium* and *Torpedo* studied the reaction was found to be always acid. That the reaction of the stomach contents is not due to the specific reaction of the food itself, but that instead there are both acid and alkaline gastric secretions, is proven by the fact that the alkaline secretion may be induced by the action of ergot subcutaneously injected. This drug causes certain sphincter muscles in the walls of the blood vessels of the stomach to contract strongly, and at the same time the secretion becomes alkaline. After a time recovery occurs and the secretion becomes again acid. In the case of *Scyllium* and *Torpedo* there are no sphincter muscles in the walls of the vessels, and injection of ergot gave only negative results; the reaction remained acid. Microscopical examination of the walls of the stomach of *Raja clavata*, in which the reaction was alkaline, showed the sphincters of the vessels so strongly contracted that there was only a very minute opening in the center. The hindrance of the blood flow caused by this contraction of the walls of the vessels seems to be the immediate cause of the pouring out of the alkaline secretion. R. P.

Oker-Blom, M. Eine Normal Elektrode für physiologische Zwecke. Arch. f. d. ges. Physiol. 79: 534-536, 1900.

The necessity for frequent change and renewal of its contents is a defect which has long been felt in the ordinary physiological, "unpolarisable," zinc-sulphate electrode. These electrodes dry up quickly, and if it becomes necessary to use them in contact with different

fluids, they must be cleaned and refilled after each change of condition. Oker-Blom has devised an electrode which in large measure gets rid of these difficulties, and is constant in its working.

A glass tube, A (Fig. 1), of about 1.2 cms. diameter and 6 cms. in length, is closed at one end and has fastened to the side near the closed end a smaller tube, B, of the form shown in the figure. Over the top of this smaller tube is fitted a small cap, bearing at its outer end a camel's hair brush. The upper end of the main tube is closed by a rubber tube and a spring clamp. Into the bottom of the tube A is melted a platinum wire, through which external electrical connection is made. This platinum wire is covered with about 1 c. c. of quicksilver, over which is placed some calomel. The apparatus is then filled with "physiological salt solution" (.7 per cent. NaCl). This can be done most easily by removing the cap bear-

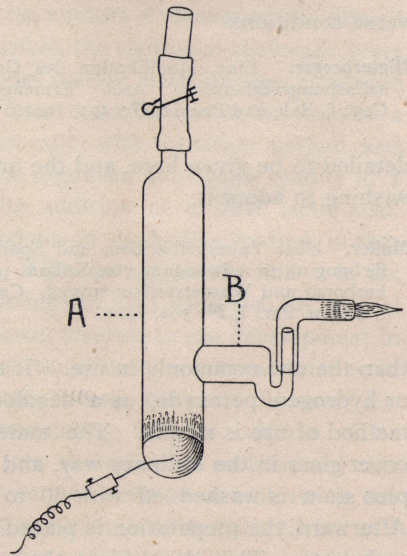


Fig. 1.

ing the brush and attaching in its place a rubber tube, which is allowed to dip into some salt solution. Then by applying suction at the upper end of the main tube A, the whole electrode may be filled. When desired for use, the cap bearing the brush may be filled with the salt solution and slipped over the end of the tube B, care being taken not to allow the entrance of any air bubbles. When not in use the end of the tube B is corked, thus preventing any evaporation of the solution. The author says: "Once in order, the electrodes are always ready for use and are very constant."

R. P.

CURRENT BACTERIOLOGICAL LITERATURE.

H. W. CONN.

Separates of papers and books on bacteriology should be sent for review to
H. W. Conn, Wesleyan University, Middletown, Conn.

Schultz. Ueber die Lebensdauer von *Bacillus pestis hominis* in Reinkulturen. Cent. f. Bac. u. Par. II, 27: 12, 1901.

Schultz has had an opportunity of investigating cultures of pest bacillus, which are four years of age. He finds

that these cultures are still filled with active bacteria, and are virulent. The question as to the condition assumed by the bacteria in these cultures has been carefully studied, with the following conclusions: The pest bacillus does not produce endogenous spores. Its resisting power, lasting for four years, appeared to be due to a condensation of the protoplasm of the bacteria rods, which serve the same purpose as spores. These shriveled bacilli are capable of resisting adverse conditions.

H. W. C.

Hinterberger. Eine Modifikation des Geiselfärbungsverfahrens nach Ermengen. Cent. f. Bak. und Par. II, 27: 597, 1901.

This article gives a convenient and useful modification of the method of staining flagella. The method is too

detailed to be given here, and the original article must be referred to by those wishing to adopt it.

H. W. C.

Müller. Über Tuberkelbacillen, und Sporenfärbung unter Anwendung von Kalium percarbonat und Wasserstoffsperoxyd. Cent. f. Bac. u. Par. I, 29: 791, 1901.

The author gives an improvement of the method of staining tubercle bacilli, which he thinks is far more sure to detect the presence of these organisms

than the one commonly in use. It consists in the use of calcium percarbonate, or hydrogen peroxyde, as a decolorizing medium, in the place of acid. The method of use is simple. The material containing the bacilli is fixed upon a cover-glass in the ordinary way, and stained as usual in carbol-fuchsin. The surplus stain is washed off with 60 to 70 per cent. alcohol, and then with water. Afterward, the preparation is placed in a 5 to 10 per cent. solution of calcium percarbonate. This decolorizes the preparation, a quarter of an hour being required for the purpose. After this a counterstain with methyl blue follows. In the use of hydrogen peroxyde, essentially the same method is followed, hydrogen peroxyde being used for decolorizing instead of calcium percarbonate. The

hydrogen peroxyde acts quickly, only a few moments being required for decolorization. The result is far more sure than by decolorization with acid. The tubercle bacilli are never decolorized, and will be found, in the end, fully stained with the carbol-fuchsin, whereas the decolorization of other organisms is perfect. The author thinks the method vastly superior to the methods commonly used for this purpose.

H. W. C.

Dains. A Pseudo Tetanus Bacillus. Journ. Boston Soc. Med. Science. 5: 506, 1901.

The author studies the case of a boy, wounded by a blank cartridge, in regard to whom there were some fears of tetanus. For the purpose of study the wound was examined microscopically, and there was found in it a bacillus having a great resemblance to tetanus. The patient, however, made a rapid recovery and never showed any symptoms of the disease. This led to a special study of this tetanus-like bacillus, which is given in the article referred to. The resemblance to the tetanus bacillus was very great, the organism having the same general appearance, and producing spores on the end in the typical manner. It differed, however, from the tetanus bacillus chiefly in the following points: It is decolorized by Gram's method, while the tetanus bacillus is not. The flagella are less numerous than those of tetanus bacilli. It is not pathogenic for guinea pigs, while the tetanus bacillus is markedly pathogenic for these animals. Its growth in glucose and stab culture is wholly unlike the growth of the tetanus bacillus, and it does not liquefy gelatin, while the tetanus bacillus does. The organism is quite different, evidently, from the tetanus organism which it so closely resembles.

H. W. C.

Poynton and Paine. The Etiology of Rheumatic Fever. Lancet, 1900.

These authors endeavor to confirm, if possible, the claim that rheumatic fever is a disease due to micro-organisms. By proper culture methods they succeeded in isolating from several cases of rheumatic fever a bacterium in the form of a coccus, with a diameter of $.5 \mu$, which does not color with the Gram method, and does not grow in ordinary culture media. The organism does grow readily in a culture medium of bouillon and milk, with the addition of a little lactic acid. This organism they found in a variety of exudates in the bodies studied, in that of the pericardium, in the heart's blood, etc. They do not usually find it in the tissues themselves. Experiments of inoculating animals with the pericardial fluid from individuals suffering from this disease resulted in the development in the animals of an infection which has many of the distinctive characteristics of rheumatic fever, and which the authors naturally infer is the same disease. Essentially the same results were obtained by inoculating bacteria cultures. The coccus grown on agar tubes was inoculated into the veins of rabbits, and this was followed by manifest disturbances which were of a nature to indicate to the authors that they were dealing with an infection similar to rheumatic fever, and produced by the coccus in question. The authors think their organism identical with that previously found by Achalmé and others, and regard their observations, therefore, as a confirmation of the view that this disease is a bacterial disease, produced by the micro-organism which they have studied.

H. W. C.

NOTES ON RECENT MINERALOGICAL LITERATURE.

ALFRED J. MOSES AND LEA McI. LUQUER.

Books and reprints for review should be sent to Alfred J. Moses, Columbia University, New York, N. Y.

Viola, C. Ueber optische Erscheinung am Quarz und am Turmalin von Elba. Zeit. f. Kryst. **32**: 551-560, 1899.

Wülfing, E. A. Ueber die Lichtbewegung im Turmalin Centralblatt. f. Min. Geol. u. Palaen. Pp. 299-302, 1901.

Viola claims that the indices of refraction for quartz can be determined from a cut plate by the Abbe refractometer with exactitude to the *fifth* decimal place. From *two* sections cut from

the same crystal of quartz, one parallel, the other perpendicular to the optic axis, he obtained for the ordinary ray with sodium light:

ω (transmission parallel axis) 1.54426.

ω (transmission perpendicular to axis) 1.54442.

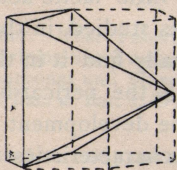
That is, a difference of 0.00016.

From which he concludes that the wave surface consists of two rotation ellipsoids, and that the Fresnel theory is not here available.

In tourmaline, using, however, the prism method, but using two different prisms from the same crystal, he obtains for the ordinary index in Elba tourmalines with sodium light:

			Transmission Parallel axis.	Transmission Perpendicular axis	Difference.
Yellow crystals,	-	-	1.6494	1.6482	0.0012
Colorless crystals,	-	-	1.6425	1.6402	0.0023
Green crystals,	-	-	1.6479	1.6503	0.0024

Wülfing objects to the conclusions of Viola, pointing out that in the case of quartz, in spite of great care in observation and in construction of the apparatus,



it is not possible to claim absolute freedom from error to the fourth decimal. In case of tourmaline, he points out the well known variation in composition in different portions of same crystal. To avoid this he prepared a single four-sided pyramid, so that both directions of transmission were through the same material, as in the figure, the dotted lines represent

the portion of the tourmaline that was ground away.

With such pyramids he obtained for ω :

			Transmission Parallel axis.	Transmission Perpendicular axis.	Difference.
Elba Colorless I,	-	-	1.6419	1.6419	0.0000
Elba Colorless II,	-	-	1.6418	1.6418	0.0000
Elba Colorless III,	-	-	1.6424	1.6423	0.0001
Haddam Green,	-	-	1.6401	1.6400	0.0001

That is, the greatest difference was $\frac{1}{12}$ to $\frac{1}{24}$ that obtained by Viola, and indicate that, at least for tourmaline, the Fresnel law holds.

A. J. M.

Gareiss, A. Ueber Pseudomorphosen nach Cordierit & Tschermak's. Min. u. petrog. Mitth. 20: 1-39, 1900.

Entirely aside from synonyms, some twenty names have been given to pseudomorphs after cordierite (iolite)

which are simply stages and phases of decomposition, the usual final product of which is muscovite or biotite. The author examines most of these, and concludes that the decomposition starts from a network of clefts in the cordierite, sometimes arranged irregularly, at other times parallel, both to base (001) and the cleavage (010). In several instances clefts were also observed parallel to the prism (110).

These alteration clefts in some instances serve only as central canals for the transportation of material, and enclose a fine grained zone. At other times this zone is surrounded by another, in which extinction takes place in perfect unity with the cordierite, but differs in the color and the lowered double refraction, which may reach isotropy. Frequently this material fills the entire space between the canals, and the entire crystal becomes thus "intermediate" substance composed of undeterminable fibers and little scales.

A third type of cleft shows little fibers or scales perpendicular to the central canal, and frequently with brilliant interference colors.

The final products of the decomposition are mica and chlorite, and some quartz. The MgO of the iolite gradually diminishes, and water, alkalies, and iron enter. The mica is usually muscovite, rarely biotite, and in one case paragonite. The tendency to form muscovite is shown by the fact that this exclusively is formed from cordierite in granites and gneisses (which are rich in potassium), whereas in cases such as the cordierite in quartz lenses in mica schist, where little potassium is obtainable, the pseudomorphs consist principally of chlorite.

Upon the basis of alteration product the author proposes the following nomenclature, which is practically in conformity with the *original* use of each name:

Pinite.—Preponderating final product mica, and without lamellar parting parallel (001). Here are included the occurrences of Schneeberg, Auvergne, Silberberg, Schönfeld, and Fichtelgebirge.

Gigantolite.—Preponderating final product mica, and with lamellar parting parallel (001). Here are included the pseudomorphs from Heidelberg and Wasserhäuseln.

Prasiolite (Praseolite, wrong orthog.).—Preponderating final product chlorite, and without lamellar parting parallel (001). Here are included the occurrences from Bamle, Kragerøe, and the Alpine pseudomorphs, which show no lamellar parting.

Chlorophyllite.—The preponderating end product chlorite, and with lamellar parting parallel (001). Here belong the occurrences of Haddam, Unity, and the gigantolite of Tammela, the lamellar fahlunite of the Talkschiefer, and the Alpine pinites with lamellar parting.

As to the many other names the author points out the essential identity of several, as shown by descriptions. These may be summed up as follows:

Esmarkite = Chlorophyllite.

Raumite = Prasiolite.

Weissite, Triclasite and Huronite = Fahlunite, but fahlunite not in every instance a cordierite pseudomorph.

Iberite = Gigantolite.

Bonsdorffite = Prasiolite.

Micarrell *Friesleben* = Kataspilite *Igelström*, which is not a cordierite pseudomorph according to author.

MEDICAL NOTES.

GRAM'S METHOD FOR STAINING DIPHTHERIA BACILLI.—Allow the fixed specimens to remain for 20 to 30 minutes in an anilin-water solution of gentian violet, prepared in the following manner:

To 100 c. c. of distilled water add, drop by drop, anilin oil until the mixture is opaque. Shake well after each addition of anilin oil. Filter through moistened filter paper until perfectly clear. To 100 c. c. of the filtrate add 10 c. c. of absolute alcohol and 11 c. c. of concentrated alcoholic solution of gentian violet.

After remaining the required time in this mixture the specimens are placed for about five minutes in the following iodine solution:

Iodin,	1 gm.
Potassium iodide,	2 gms.
Distilled water,	300 c. c.

This solution should be allowed to act until the specimens are black, after which they are thoroughly washed in alcohol, which removes the black color, causing the specimens to appear pale grey.

Dry and mount in balsam, or contrast stain with carmin or Bismark brown.
C. W. J.

Piorhowska. The Staining of Diphtheria Organisms. *Berliner klin. Wochens.*, Mar. 4, 1901.

A method is given by which the author believes it possible to demonstrate positively the existence of these organisms

by staining. Make dry cover-glass preparations from a culture of bacilli grown on either glycerin-agar, or Loeffler's blood serum, at a temperature of 37.7°C. for 15 to 20 hours. Stain for 20 to 30 seconds with methyl-blue. Decolorize in 3 per cent. solution of HCl-alcohol for 5 seconds. Counterstain in 1 per cent. aqueous solution of eosin for 5 seconds. Polar nuclei stain deeply, and the central portion takes a marked red color.
C. W. J.

Boston, L. Napoleon. How to preserve as permanent specimens casts found in urine. *Rep. N. Y. Med. Jour.*, Nov. 4, 1899.

Partially fill a bottle with urine, cork tightly, and allow to stand in a cool place until a precipitate collects at the

bottom of the liquid. Decant the supernatant urine, add an equal quantity of distilled water to the precipitate, and allow it to stand until it collects again at the bottom of the liquid. With a pipette place a small drop of the thickest of the sediment on the center of a slide and examine under low power. If casts are present, evaporate the mount nearly to dryness and add by means of a glass rod to the center of the drop of urine a drop of the following mixture:

Liquor acidi arseniosi (U. S. P.), one fluid ounce.
Salicylic acid, half a grain.
Glycerin, two fluid drachms.

Dissolve by heat and add acacia (whole tears), and again warm until the solution is saturated; after subsidence, decant clear supernatant liquid, and add a drop of 40 per cent. formalin if desired.

In order to get an equal distribution of casts throughout the field, it is necessary to draw a fine needle from the outer margin of the urine to the center of the medium until the two substances show no tendency to separate. A cover-glass is moistened by the breath and then allowed to fall gently on the specimen. Cool the slide for a few hours in order to harden the mount completely. Specimens thus prepared may be kept indefinitely without deterioration.
C. W. J.



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ALL new subscribers to the volume for 1900, paying the full subscription price of \$4.00 a year in advance, may obtain the back volumes for the years 1892, 1893, 1894,* 1895, 1896, and 1897, upon the following terms: any single volume will be sent upon payment of \$2.00; any two volumes for \$3.50; any three volumes for \$4.00; any four volumes for \$4.50; and five or six volumes for \$1.00 each, in addition to the regular subscription. This offer holds good until the stock of back volumes is exhausted. Volumes for 1898 and 1899, \$4.00 each.

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A MOUNTAIN CLIMBER.

Gains Twelve Pounds on Change of Food.

When a change in food can rebuild a man seventy-seven years of age, it is evidence that there is some value in a knowledge that can discriminate in the selection of proper food to rebuild the body. A few months ago the physician attending Warren S. Johnson of Colfax, Cal., seventy-seven years old, told him that death from old age would soon claim him. He suffered from general weakness and debility.

An old lady advised him to quit coffee and drink Postum Cereal Food Coffee and to eat Grape Nuts breakfast food every morning. He took the advice, and has gained twelve pounds. Says he is as well as he ever was, and can take long trips in the mountains, which he has been unable to do for a long time.

There is a reason for this; in the first place, coffee acts as a direct nerve destroyer on many highly organized people, both young and old, and many people haven't the knowledge to select nourishing, healthful, rebuilding food.

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The experience, suffering, and slavery of some coffee drinkers would be almost as interesting as the famous "Confessions of an Opium Eater," says a Boston man, W. J. Tuson, 131 W. Newton St. "For twenty years I used coffee at the breakfast table and, incidentally, through the day, I craved it as a whiskey drinker longs for his morning bracer. I knew perfectly well that it was slowly killing me, but I could not relinquish it.

"The effect on the nervous system was finally alarming and my general health greatly impaired. I had dyspepsia, serious heart difficulty, and insomnia. When I would lie down I would almost suffocate. My doctor assured me it was due to action of caffeine (which is the active principle of coffee) on the heart.

I persisted in its use, however, and suffered along just as drunkards do. One day when I was feeling unusually depressed, a friend whom I met looked me over and said: 'Now, look here, old man, I believe I know exactly what's the matter with you. You are a coffee fiend and it's killing you. I want to tell you my experience. I drank coffee and it ruined my nerves, affected my heart, and made me a sallow, bilious old man, but through a friend who had been similarly afflicted, I found a blessed relief and want to tell you about it. Try Postum Food Coffee, a grateful, delicious beverage, full of nourishment, that will satisfy your taste for coffee and feed your nervous system back into health, rather than tear it down as coffee has been doing.'

I took my friend's advice, and within a week from that time my digestion seemed perfect, I slept a sweet, refreshing sleep all night, and my heart quit its quivering and jumping. I have been steadily gaining in health and vitality right along."

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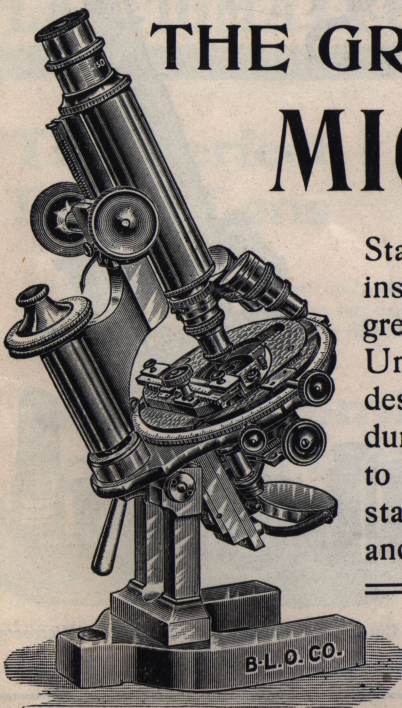
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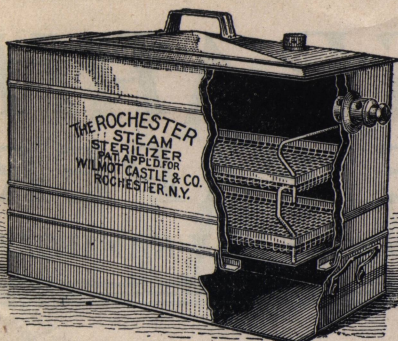
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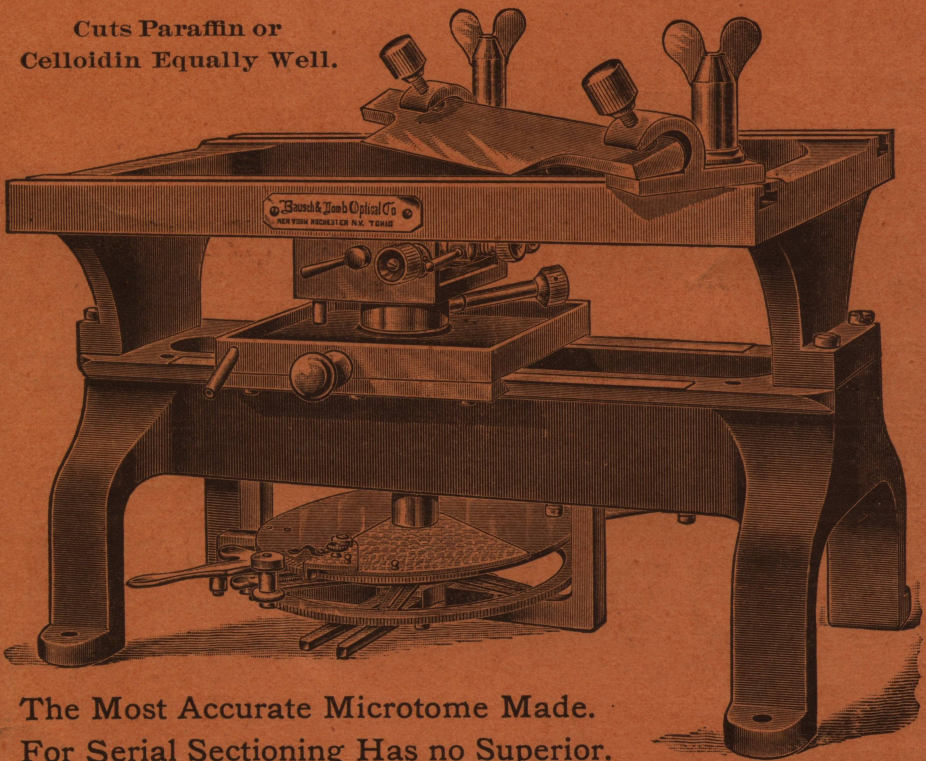
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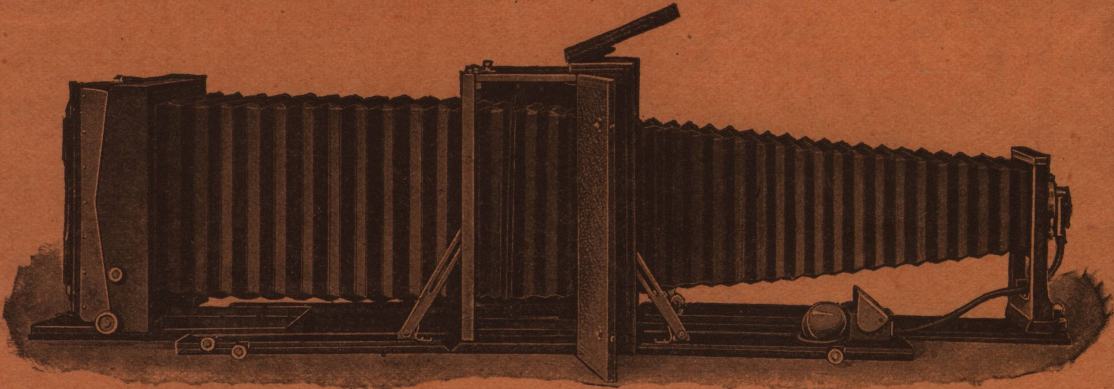
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